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EDUCATION OF THE ELECTRICAL CONTRACTOR.

Many of the recent discussions of conditions in the field of electrical contracting have been of such a character as to lead the layman to form an opinion of the contractor which is anything but flattering to him. The curbstone contractor, that is, the man whose patronage and profits have not grown to the proper proportions to warrant his maintaining an office or a shop, has sometimes been subjected to criticism but little short of abuse. The low financial rating of contractors as a class has been proclaimed in high places, and the fact that they are regarded as the poorest of credit risks has often been emphasized with tiresome reiteration. Moreover, there are those who would apparently have us believe that the average contractor is imbued with a sort of innate fondness for competition fatal alike to his own success and that of his associates in the trade as well.

Investigation of actual conditions, however, would doubtless reveal the fact that such contentions as the foregoing are quite liable to be misleading, if not altogether unfair. For example, some of the now most successful contractors in the country were men who came originally from the ranks of the practical wiremen or journeymen electricians, and who, for a while, at least, after going into business, sometimes had neither shop nor store nor office, and did only the small jobs of wiring that their then very limited resources permitted them to undertake.

It should be explained here, though, that these remarks are not intended as an argument that any contractor should necessarily continue to do business in this way long. In fact, the man whose judgment, in a business way, is reasonably sound and who is possessed of a normal amount of aggressiveness does not usually remain long in this class. But the common argument that a given contractor's methods are poor simply because he happens to be in the curbstone class, is based on a line of reasoning which is distinctly faulty. As a matter of fact, it is the man's way of doing business which fixes his rank in the trade, and not his rank which determines his methods.

The generally poor financial standing of the electrical contractor is a matter of record, of course; and the prevalence of an unwarranted and unfortunate competition in the field of electrical construction is likewise recognized and admitted. The first of these

two conditions, however, is for the most part the resultant of the second and the second arises from the most natural of causes. The contractor's early training has usually been solely along the lines of electrical construction; he has learned how to do good work, but not how to charge for it. Moreover, not having learned the proper relation of net profit to volume of business, he easily becomes the victim of the illusion that his own preservation depends upon the amount of business done, and thus engages in a sort of competition ultimately destructive to his own welfare and that of others in the trade as well. In short, what the contractor needs most of all now is a more thorough and intensive education along lines of correct business policy and management.

In view of the foregoing conditions, the recent efforts of certain organizations of contractors in the matter of education are particularly encouraging. It may be added, too, that there has probably been no more notable movement in this direction than the recent action of the Illinois Contractors' Association. It will be recalled that one member of that body, Mr. J. N. Pierce of Chicago, in order to stimulate investigation in the matter in question, contributed a sum of $300 to be awarded for the best papers on contracting presented before the convention of the association. The same generous spirit was manifested also in the convention in providing for a systematic campaign for the education of the contractors of the State, which is now being put into definite and practical form. Such action as this must necessarily do much toward placing contracting on the high plane which it should occupy in the electrical industry.

DEVELOPMENTS IN THE ELECTRIC FAN INDUSTRY.

At a time when most people are tiring of the tenacious prolongation of winter it is indeed a pleasure to allow the mind to look forward to the balmy days of spring and summer. But with the gentle zephyrs will also come days of torrid, sweltering heat when the demand for the cooling breezes from electric fans will again reach its peak.

Electric fans have been built for well over a score of years during which valuable features have been added from time to time and weak points eliminated, the aim always being to make the device more serviceable and also more rugged. A fairly comprehensive summary of the developments that are incorporated in this year's product is given on other pages of this issue. This shows that the manufacturers have made some important improvements, which, though seemingly relating to details only, will have rather far-reaching results in extending the usefulness of the electric fan, particularly in the home, where it has received but limited application heretofore.

Probably the most striking feature to be noted is the employment, by several makers, of drawn steel or brass instead of cast iron for the casing and base of the machine. This alone has meant a reduction in total weight of some forty or more per cent, which means that a fan can readily be picked up by the lady of the house, or even a child, and placed where its breeze will be most effective. The use of these new materials also gives a neater appearance to the fan, both on account of the more graceful lines which it makes possible and the high finish that can be given to the entire case.

This is shown by the popularity of the eight-inch fan for service in residences, particularly in bedrooms where its ease of adjustment and low energy consumption make it possible to provide refreshing breezes throughout hot, sultry nights.

There is practical standardization now of the 8, 12 and 16-inch sizes of desk fans, all of which are made readily adjustable for wall or bracket mounting. In oscillating fans there is a tendency to use the worm-gear drive more generally and thus secure a slow, gentle swing through a wide, adjustable angle, instead of the rapid and small swing that has usually been accompanied by noisy flapping of vanes. This permits the fan to give a more thorough blow through all parts of a room in place of a series of sudden puffs. Some manufacturers make the wearing parts of the oscillator mechanism renewable without shipping the entire fan back to the factory.

Alternating-current fan motors are now made self-starting without the need of centrifugal or other mechanical devices. More reliable speed changes are also provided for these machines. Interchangeable direct-current and alternating-current motors are not quite so commonly used.

Referring to the adaptation of the electrically driven fan, new uses for it are being discovered almost every day. Particularly is this true in connection with ventilating systems of all sorts in which it can be placed wherever needed and used for blower or exhaust purposes or to merely stir up large volumes of air. A former commissioner of health in one of our largest cities is advocating the liberal use of electric fans in schoolrooms to thoroughly mingle the inlet air with that in the breathing zone of the pupils. It is more certain every day that railroad and street-car ventilation will require an electric fan to produce positive results.

For industrial service space permits mention of but a few uses of the electric blower or fan. Among these are the production of mechanical furnace draft, blast for blacksmiths' forges, cooling of large turbo-generators and other machinery, sand blasting, suction removal of ashes and shavings, exhausting of noxious fumes or gases. These various uses, together with the greatly increased employment of vacuum cleaners and the standard lines of desk and ceiling fans, have proved a great stimulus to the electric-fan industry. They should bring about the development of new features that will give the fan still greater utility. The central-station interests should co-operate also in promoting the more general use of this valuable aid to the comfort, health and economy of modern life.

PUBLISHERS' ANNOUNCEMENT.

On March 9 the publication offices of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN will be removed to the Heisen Building, 608 South Dearborn Street, Chicago. Every department of the organization has been enlarged; the REVIEW has outgrown its present quarters. Additional facilities, particularly in the editorial, subscription and art and copy departments, will enable us to more adequately handle the growing demands of readers and advertisers. In our new quarters, as we have in those we leave with many happy recollections of our introduction to this great Western metropolis, we will be glad to have our friends meet with us, making this their headquarters for electrical information. Our other offices, in New York, Detroit, and London, England, will in nowise be affected.

CARRYING CAPACITY OF THE NEUTRAL IN THE THREE-WIRE CIRCUIT.

The main advantage of the three-wire system for the distribution of direct-current or of single-phase alternating-current arises, of course, from the saving in copper which the adoption of this system makes possible. As is well known, in a circuit having the three wires of the same size the weight of the conductors needed to transmit a given amount of power at a given line loss is but three-eighths of that required for the transmission of an equal amount of power with the same loss of energy in the line by means of two-wire circuits. Moreover, the fact that where the system may be kept closely balanced the neutral wire need not be so large as the other two is often taken advantage of to secure a still further reduction in the cost of the circuit. It would appear, then, that in cases where the quantity of power to be delivered and the length of the circuit are at all considerable, any argument against the use of three-wire distribution would not generally be worth while; provided, of course, that the load to be carried was adapted to three-wire service. The rather common practice of installing for the neutral of the circuit a wire of smaller carrying capacity than that of one of the outside wires is by no means always a wise procedure. In actual practice the cases are numerous in which one cannot be at all certain that the proper balance will be maintained on the circuit; and if any considerable unbalancing does occur, unsatisfactory voltage regulation and even a serious overload of the neutral is quite liable to result. Moreover, for indoor wiring when the neutral is smaller than the other wires, it must always be protected by a fuse, and the blowing of the neutral fuse will often put receiving apparatus of unequal current capacities in series, thus temporarily embarrassing the service.

In this connection the discussion along the foregoing lines by the National Electrical Inspectors' Association, which will be found in this issue, is particularly interesting. This discussion, participated in by members from rather widely separated parts of the country, indicates what is the current practice relative to three-wire circuits. It will be noted that while the inspectors state that so far as the fire hazard is concerned the neutral, properly fused, may be made smaller than the other two conductors, there is no disposition on their part to recommend this practice. The instances are certainly quite numerous in which it is not to be desired.

ELECTRICITY IN BUILDING CONSTRUCTION.

There are few industries to which the electric motor is better suited than to excavation work, yet a few years since, a contractor would have received with incredulity the suggestion that his machinery could profitably be driven by such motors. The delay in introducing electricity into construction work is chargeable to the central stations in not allowing contractors sufficiently low rates, due to the temporary nature of their plants; to the manufacturers of contractors' machinery for their failure to realize the march of progress, and to the contractors themselves, due to a natural reluctance to abandon steam and air-driven machinery.

Conditions today are changed and it would be difficult to find a prominent contractor who does not appreciate the advantages of electrical operation of his machines. The statement that the application of electricity in building construction results in a saving of both time and money is well founded and is borne out by the data presented elsewhere in this issue.

Two of the most important advantages in the use of electricity for construction work are the simple manner in which the electrical equipment can be installed, and the ease with which it can be re-located when necessary. This latter feature is particularly advantageous in the building of structures of great magnitude where the scene of operations is constantly changing.

The usual contractor's steam plant requires licensed attendance—in cold weather both day and night, for whether the plant is in operation or not fires must be kept up and steam passing through the pipes to keep the drips from freezing. The electric motor, on the other hand, may be covered with a tarpaulin and left thus until needed for service, and this in any kind of weather. With the steam plant, further, there is the inevitable coal and ash heap and the ever present fire danger. This last is always a serious consideration and is avoided altogether with electric motor service. Smoke and soot to stain marble or light-colored stone or brick is likewise avoided.

There is no question as to the desirability of this business from the central-station standpoint. In some localities the load is entirely an off-peak one and in others operations are carried on continuously for 24 hours. In either case the supply companies, by co-operating with building contractors in the selection of proper machines to do the specific work imposed upon them, and by granting attractive rates, can participate in the business which building activities bring.

Oklahoma Telephone Meeting.

George A. Henshaw, member of the Oklahoma Corporation Commission, is emphatically of the opinion that two telephone exchanges in one city are a nuisance and an unnecessary burden upon the community, and so expressed himself in an address before the Oklahoma Telephone Association, in session in Oklahoma City. He also discussed the matter of physical connection, which has been receiving a great deal of attention from the Commission, and stated that the Commission's attitude will be to deal with each application strictly on its merits, with the idea of preventing duplication of long-distance service wherever possible. He stated that with the exception of a few specific cases now under consideration by the Commission, conditions in the telephone business in Oklahoma seemed to be satisfactory.

The members of the Association decided that the rates now charged by exchanges for switching calls for rural and mutual telephone companies was too low, and appointed a committee to investigate and agree, if possible, upon a satisfactory rate.

These officers were elected: President, R. S. Goffe, of Sulphur; vice-president, W. J. Steele, of Kingfisher; secretary-treasurer, Horace Truman, of Geary.

New York Jovian Luncheon.

The Jovians of New York City, with Statesman F. E. Watts presiding, lunched together to the number of about 150 on Wednesday of last week.

Henry L. Doherty delvered an address of special interest to the wage-earner, presenting much valuable matter and illustrating with a series of diagrams.

Announcements were made by Statesman F. E. Watts, P. S. Dodd and C. W. Elliott, the latter announcing the election of T. C. Martin to honorary membership in the Sons of Jove, as stated in a telegram received from Robert L. Jaynes, the reignng Jupter. Mr. Martin was present and responded briefly and gracefully in appreciation of the honor.

Mr. Watts stated that the growth of the New York Jovian organization is continuing very satisfactorily.

Franklin Institute Awards Medals.

The Franklin Institute, through its Committee on Science and the Arts, has awarded the Elliott Cresson gold medal, the highest in the gift of the Institute, to

Alexander Graham Bell, Washington, D. C.

Samuel W. Stratton, Washington, D. C.

Albert A. Michelson, Chicago, Ill.

Alfred Noble, New York, N. Y.

Elihu Thomson, Swampscott, Mass.

Edward W. Morley, West Hartford, Conn.

Johann F. A. von Baeyer, Munich, Germany.

Sir William Crookes and Sir Henry Enfield Roscoe, London, England.

Some Factors Entering Into the Fixing of Rates.

On February 20, William J. Norton spoke before the Commonwealth Edison Section of the National Electric Light Association, on the subject "Some Factors Entering Into the Fixing of Rates." As Mr. Norton is one of the members of the Rate Research Committee of the Association his remarks on this subject were of particular value.

In taking up the subject he reviewed briefly the development of the various rate systems and mentioned the obvious unfairness of the flat rate and the straight meter rate, which have been replaced by the Doherty three-charge method, the maximum-demand system, and variations of the two. Really only two points need be considered in fixing rates; the operating expenses and the value of the property but both of these involve a great deal of investigation and calculation.

The cost of reproduction, that is, the cost of a plant which could take over the load of the present plant, is in most cases a fair valuation, and the fact that this method has been adopted by some commissions in making valuations of public-utility plants gives it standing.

An interesting set of curves illustrating the prices of power in various cities was used in connection with the discussion of results obtained and it was interesting to note that the prices of the Commonwealth Edison Company were lower than those of other large companies. The figures were obtained on the basis of a definite number of lamps burning in a six-room apartment, church, office, ten-room dwelling, retail store, print shop, manufacturing plant, saloon, etc.

In the discussion Mr. Fowler spoke briefly of the rates of the Commonwealth Edison Company, mentioning the part that the railway and power load played in reducing all rates in Chicago.

H. B. Gear, discussing the question further, spoke of his work in connection with finding the diversity-factor of a large apartment house and the influence of the diversity-factor on rates. He stated that in the apartment house he found that the diversity-factor was 1 to 3 and by considering numerous apartment houses, the factor at the station could be taken as about 1 to 5.

A number of other members also joined in the discussion.

Meeting of New York Section.

John F. Gilchrist, president of the National Electric Light Association, was present at the February meeting of the New York Companies Section of the Association, held on February 19 at the Edison Auditorium, New York City. Mr. Gilchrist delivered an address entitled "The Aim and Scope of the National Electric Light Association," in which he told a good part of the history of the organization from its birth, and went into details as to why it was organized and why it stood for so much in the electrical industry. He laid particular stress upon the need of all electric lighting companies being members, perhaps more for their own good than for the good of the companies already in the organization.

Following Mr. Gilchrist, Arthur Williams, chairman of the Section, opened a discussion of the subject, "The Duty of the Public-Service-Corporation Employee to Himself, to His Company and to the Public." A number of gentlemen, representing all the companies in the Section, entered into this discussion, which brought out some very interesting points.

Following this part of the program several musical numbers were rendered, the meeting terminating with an impersonation of a meter reader's troubles in Mulberry Street.

About 400 were present to greet Mr. Gilchrist, perhaps the largest gathering since the last convention. This is about one-fourth of the membership, and an active campaign for new members is now on foot for the present year.

Practical Illumination.

At the regular monthly meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers, Ralph Beman, of the National Electric Lamp Association, read a paper entitled "Illumination for the Electrical Engineer."

After a brief introduction, in which he reviewed the definitions of fundamental photometric units, he described various commercial lighting sources, including the different kinds of arc lamps and vapor lamps, under which head mention was made of the new neon tube and incandescent lamps. Then followed a discussion of the principles of illumination and the methods of calculating illumination. A new chart for the rapid calculation of illumination by the flux-of-light method was explained. A third division of the talk was devoted to the design of practical installations; numerous slides were shown illustrating the different systems of illumination now in use. The paper closed with a discussion of the economic operation of incandescent lamps and the method of maintaining the equipment in efficient condition.

An interesting discussion followed.

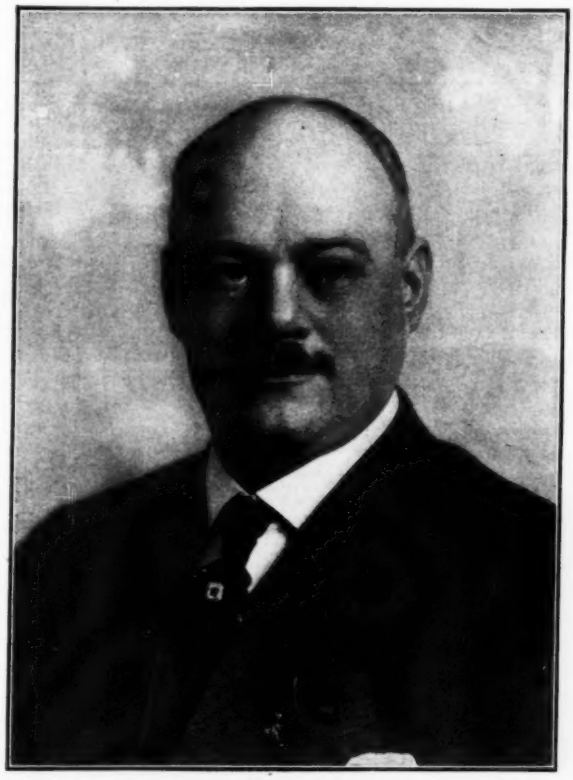
Alfred C. Einstein.

The Union Electric Light and Power Company, St. Louis, Mo., is one of the most enterprising and progressive central stations in the country. This is an institution that believes in going out after business and convincing everyone within the radius of its lines that the use of electrical energy in both industrial and domestic applications is not only an economical but a philosophical and logical necessity. The company has been fortunate to a degree in the choice of those set at the head of its organization for the direction of its affairs and the rise of the company as a big factor in the central-station business of the country has been marked by a development of many men now holding prominent positions in other parts of the electrical world.

Alfred C. Einstein, who was recently appointed first vice-president and general manager of the Union Electric Light and Power Company, is well known and held in high regard by St. Louis people. He has had a wide experience in the construction, operation and management of public utilities.

Mr. Einstein was born in Hoboken, N. J., and educated in the schools of St. Louis. He is a graduate of the Manual Training School, St. Louis, and spent several years in Washington University, but quit his studies there before receiving a degree to accept a position as manager of a mining property in Silver City, Mexico. He returned to St. Louis in 1890, and was elected president of the Consolidated Engineering Company, engaged in constructing gas and electric plants in various sections of the United States. Later on Mr. Einstein became connected with and purchased an interest in the Paducah Electric Light and Street Railway Company, Paducah, Ky. He was elected president of this company and brought the property to a high degree of prosperity. He sold his interest in this organization in 1896 and purchased the Suburban Electric Light and Power Company of St. Louis County. Shortly after acquiring this property he organized the St. Louis County Gas Company. He disposed of the Suburban Electric Light and Power Company, and in 1904 purchased the King Electric Light and Power Company, which was later merged with the Suburban Electric Light and Power Company.

Mr. Einstein retains the presidency of the Suburban Electric Light and Power Company and the St. Louis County Gas Company in addition to the present important post. He is thoroughly familiar with the entire electric lighting and power field in St. Louis and its suburbs, and he has taken an active interest in civic betterment affairs. As successor to Alten S. Miller, Mr. Einstein, together with the other young and aggressive officers of the Union Electric Light and Power Company, will carry forward a clean-cut policy which is extending and popularizing the company's business in a very happy fashion. The growth which has come to the company within recent years and the opportunities for still greater development made it necessary that a man of wide experience and special attainment as a manager be secured to direct the affairs. It is a matter of congratulation, therefore, that the company in this emergency was able to secure in the immediate territory a man so well fitted to fill this important positon.



Alfred C. Einstein,

First Vice-President and General Manager, Union Electric Light and Power Company, St. Louis, Mo.

New England Luncheon Section Hears Plans for Boston Show.

H. W. Moses, of the Boston Edison Company, manager of the Boston 1912 Electric Show, spoke on February 23 before the Luncheon Club branch of the New England Section of the National Electric Light Association on the plans of the company for the show to be given under its auspices from September 28 to October 26. A large and enthusiastic attendance was present. Mr. Moses said that the work the company has done of late in the field of publicity is only a start toward the campaign which will reach its height when the Electric Show of 1912 opens. Two years of activity with an expenditure of $150,000 will be realities before the Show opens its doors, and the company is planning to make the exhibition the most comprehensive ever held. Other electric shows both in this country and abroad have been studied with regard to the character of their exhibits, but more especially to find out why these shows have been complete failures or at the most only fairly successful.

The company's publicity has been world-wide, and six technical magazines abroad have contained its advertisements, as well as many in America. Said Mr. Moses:

"We have made great use of personal letters to central stations, manufacturers and the representatives of foreign countries stationed here, approximately 30,000 letters having been sent out to date. At the most advantageous time, the most up-to-date and attractive form of advertising will be employed throughout New England. In this immediate vicinity there is a population of about 1,500,000 people being served by the Edison Electric Illuminating Company. In this district there are over forty newspapers (excluding Boston) which will carry spicy notices regarding the show. New England has a population of more than 7,000,000 people and through the co-operation of the New England central stations we want every one of them to hear about this show. There have been prepared several million stickers for advertising which will be sent out at the proper time for use on mail matter and packages. These stickers have been approved by the Post Office Department and may be attached to either side of an envelope. The exhibitors themselves will use them in their daily correspondence, the central stations, jobbers, supply houses and contractors will use them on their mail and the department stores will use them on their packages. Besides these stickers there will be several thousand attrac-

tive posters placed all over New England both in the show-card and billboard sizes.

"The New England Passenger Association will be asked to grant special rates from prominent New England points to Boston, during the period of the show, and will undoubtedly act favorably on the matter. Boston will be a big convention city during October; already four electrical associations have voted to meet here and the show management has offered, free, the use of Paul Revere Hall for all such meetings. During the week of Se tember 23, the fifth congress of the International Chambers of Commerce will be held in Boston, and the show management is planning for a complimentary private opening for the delegates to this convention, on Saturday afternoon, September 28.

"In addition to the above, the Retail Trade Board of the Chamber of Commerce has under consideration the holding of a mammoth merchants' week. They hope to be able to raise by popular subscription an amount sufficiently large to give the project widespread publicity so as to attract a large number of people to Boston and to the retail stores during this particular week. The plan calls for special electrical decorations on Tremont and Washington Streets, using thousands of lamps for purely spectacular and decorative purposes.

"The general character of the exhibits will be moving exhibits, which will make the show much more attractive from the visitor's point of view. As far as possible we shall limit the moving exhibits to but one of a kind so as to create a better feeling among the exhibitors themselves in that they will not have to show their goods in competition with others in the same line of business. This will make the show intensely interesting, in that each exhibit will be distinctive and complete in itself and the whole will make up a wonderfully attractive and comprehensive moving exhibit, illustrating the adaptabilty of electricity to every trade and business.

"Our designing architect informs us that it will require no less than 500 men practically 24 hours a day for ten days in order to erect the decorations. This does not include the tremendous amount of labor and wire necessary to produce the spectacular illuminating effects within the building, and the bringing of the current to the different booths for the convenience of exhibitors, nor does it include the labor and material necessary to construct the 21 arches along Huntington Avenue, on which there will be strung approximately 20,000 lamps, nor does it include the outlining of the Mechanics Building itself, with approximately 15,000 lamps. In the rear of the building a 2,000-kilowatt transformer substation will be built to supply the energy required, and it is estimated that about 500,000 kilowatt-hours will be required. We have absolutely no thought of making this show an annual affair. Such events are to be thought of only as often as occasion demands, due to the rapid development of the electrical industry, and to keep the public in touch with everything that is new in the electrical field."

Arrangements for Exhibits at Seattle.

The Exhibition Committee for the thirty-fifth convention of the National Electric Light Association, to be held at Seattle, Wash., June 10 to 13, has announced the arrangements for the exhibits. J. C. McQuiston, Pittsburgh, Pa., is chairman of this committee.

The convention headquarters will be located in the City Armory and the exhibits will be placed in the Drill Hall, which measures about 200 by 100 feet. One end of the hall is cut off by a double partition, forming a spacious meeting hall. The exhibit hall has been laid out in such a way as to provide 70 booths of good proportions, with an aggregate floor area of 8,150 square feet. Regulation prices for space will include platforms, signs, decorations and unlimited telephone service. Two chairs will be furnished free and additional furniture may be secured at schedule rates. Through the courtesy of the Seattle Electric Company, current for lighting and for the operation of exhibits will be furnished without charge. This current will be single-phase, 60-cycle, 117-234 volts.

To reduce the expense of shipping exhibits from the East the Committee is making arrangements for grouping and reshipping material from Chicago in car-load lots.

East Michigan Company Turns Current on High-Potential Lines.

The East Michigan Power Company, developing the Au Sable River for electric purposes, turned on the current for the first time last week to try out the lines, transformers, etc., and everything was found satisfactory except that the inductive effect produced in adjacent telegraph lines belonging to the Michigan Central Railway was so great as to render them inoperative. A vigorous protest on the part of the railway company resulted in the shutting down of the high-potential lines until some remedial measures could be taken. The high-tension lines operate at 140,000 volts, sixty cycles. The transmission lines occupy a private right of way, steel-tower construction being employed throughout.

Electric Music.

At the 308th meeting of the New York Electrical Society held in Carnegie Hall on February 23, an address was given by Thaddeus Cahill on "Electric Music, Its Present and Future." An illustrative program was played at the telharmonium factory at Fifty-sixth Street and Tenth Avenue and brought over the telephone wires to the meeting room. An innovation was introduced by using the wire-transmitted music as an accompaniment to songs by Madame Mira Fischer-Zarad. The program was played by Pane N. Fishbaugh and Franklin Harris.

C. O. Mailloux presided, and in his introductory remarks spoke of the relation of the work of Helmholtz and others to the accomplishment of practical results in telharmonium music. He said that beside electrical music, wireless telegraphy was simple. He considered it one of the greatest electrical developments of the present time.

In his paper Dr. Cahill gave a description of his apparatus and spoke of its possibilities and its advantages. He stated that there were radical improvements pending which would greatly raise the character of electric music, as he hopes within a few months to give the effect of stringed instruments. He pointed out the distinctions between the method used and the telephone and the phonograph. He uses a series of electric generators having different frequencies. These are controlled by a keyboard, switchboards, tone-mixers and expression devices, and the currents are superposed upon the transmitting line. The apparatus at the receiving end is actuated by the current and will produce proper vibrations necessary for all ordinary musical effects. The applications of this apparatus are very numerous and it has a number of advantages over orchestral music. The telharmonium has been for years in the experimental stage, but it has now reached the point of commercial development.

Civil Service Examinations.

The United States Civil Service Commission announces an examination on March 20 to 22 at the usual places to fill the position of electrical and mechanical engineer at from $1,800 to $2,000 per annum, in the Quartermaster's Department at large, New London, Conn., and similar vacancies.

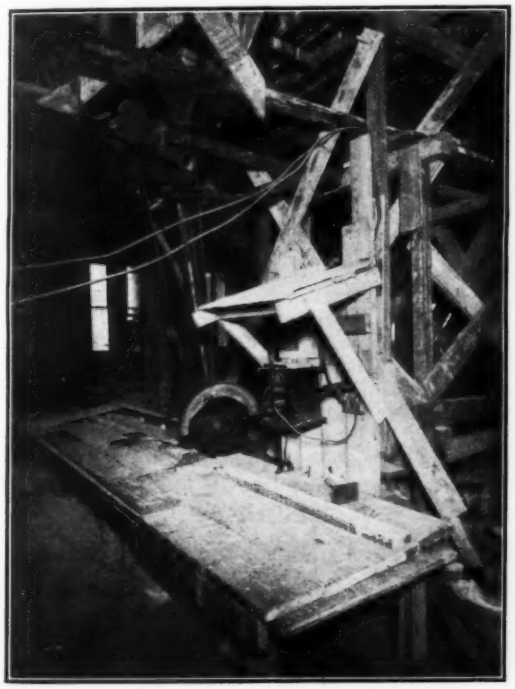
On March 20 an examination will be held for the position of laboratory assistant in the Bureau of Standards, Washington, D. C., at salaries from $900 to $1,200 per annum. Applicants for either of these positions should send for application and examination form 1312.

Electricity in Building Construction.

As the motive power for the majority of operations involved in building construction, electricity is much superior to either steam or compressed air, particularly as regards flexibility, ease of control and economy. In this article the numerous advantages of electrically driven machines are discussed, descriptions are given of the apparatus involved and numerous typical installations described.

In a number of cities throughout the country, building construction is enjoying a remarkable state of activity, which lends emphasis to the expression that this is an age of enterprise and great undertaking. Central stations have a means of participating in this activity by introducing to a much greater extent, electrically operated apparatus in construction work, and the results to be derived therefrom are most certainly worthy of deep and serious consideration.

The statement that the application of electricity to building construction results in a saving of both time and money, is well founded, as has been proven by experience. In most all large cities the electric motor, on account of its inherent advantages, has replaced the steam-engine equipment in the building of structures, both large and small, as the electrical equipment is always ready for instant use and is set in operation by the mere movement of a controller, thus eliminating the loss of time in getting up steam when a steam engine is used.



Motor-Driven Swing Saw in Rand-McNally Building, Chicago.

Motor-Driven Cut-off Saw in Rand-McNally Building, Chicago.

Two of the most important advantages in the use of electricity for construction work are the simple manner in which the electrical equipment can be installed and the ease with which it can be re-located when necessary. This latter feature is particularly advantageous in the building of structures of great magnitude where the scene of operations is constantly changing. It is well understood that its position is not determined by features which limit its installation to certain points, as is the case with the steam driven equipment. After the electrical apparatus has been moved to its new position feed wires can be changed without difficulty.

Another strong argument in favor of the electrical equipment is the reduced expense as compared with the steam engine. It will of course be seen that only the power that is actually used is paid for. This eliminates the expense resulting from the use of fuel in order that a working amount of steam may be maintained, while the equipment is not in operation, to enable work to be resumed at any desired moment. Also, a licensed engineer is required to operate a steam engine, while any one with ordinary intelligence and a short training can operate the electrical equipment.

There are also the arguments of cleanliness—no soot, smoke, ashes and dust—of no fire hazard due to flying sparks or accidently dropped live coals from the fire box, no freezing of water in winter, etc. In many cities stringent laws have been passed relative to the smoke nuisance. These laws make it necessary for the contractor, using steam engines, to purchase certain grades of hard coal or coke, the increased cost of which adds greatly to the expense of steam operation. It is also true that in the majority of cases the coal becomes so mixed with dirt, brick dust, cement, etc. that never more than three-fourths of the coal purchased is available for use. Relative to the fire hazard—several instances are on record where considerable damage has been done by flying sparks. As an example—during the construction of the First National Bank building in Chicago several years ago, sparks from a hoisting engine set fire to a number of wooden boxes on the fourth floor containing window glass. In addition to destroying the glass, the fire discolored one of the cornerstones of the building to such an extent that it was necessary to replace it, thus causing considerable extra expense.

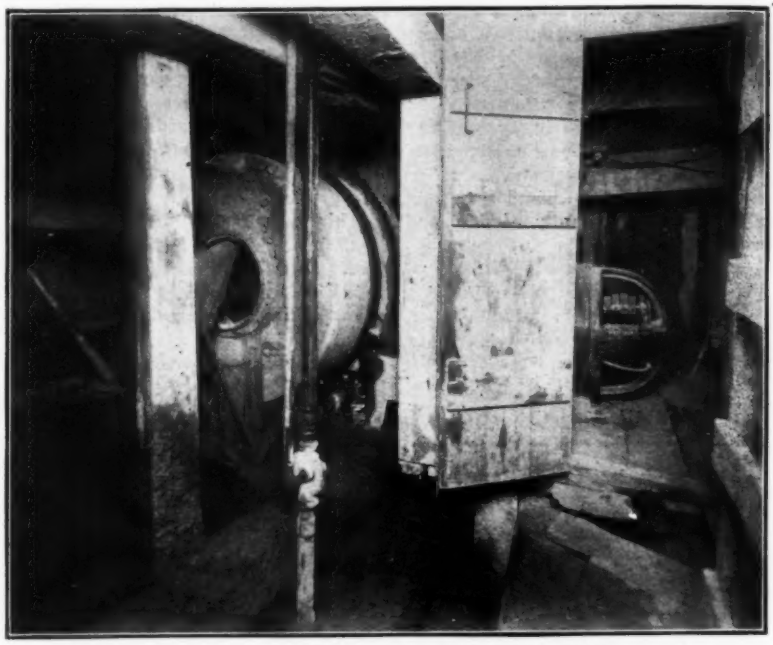
The construction of tall buildings necessitates at least a great deal of difficult and important designing, executive and constructive work. This requires a large

variety of mechanical operations, some of them on a large scale, executed simultaneously or in elaborate combination and generally with limited space, time and appliances.

The greatest single difficulty is undoubtedly the very narrow horizontal space limits, to overcome which facilities are provided for practically multiplying it at different elevations and for the most rapid handling of materials in the vertical direction. Instead of following each other many different operations are executed simultaneously and sometimes the same operations are in progress at many different places at once. Most of the structural-steel work and other large and heavy materials is hoisted from the street by the large derricks which unload trucks, allowing them to pass on, and delivering their loads approximately where required in a period of a very few minutes. Other materials like brick, broken stone, cement, etc., are quickly chuted into the cellar, raised to the required level by fast-running elevators or hoists and distributed by wheelbarrows.

Construction is started successively in the three principal parts, the substructure, superstructure and installation of equipment. Some times explorations of the soil to determine the nature of the foundations are made by borings in the cellars of the old buildings before the tenants vacate them, thus saving several weeks' time. Caisson foundations which may easily cost 10 per cent or more of the total cost of the building are sunk to rock in a few weeks by a very heavy and costly installation and pneumatic plant which covers so much ground that materials are piled high all over the excavation and on auxiliary second-story platforms, and often have to be moved again and again to make way for successive operations, thus considerably increasing the cost and difficulties of the work. Often the general excavation is not completed until after the foundations are finished and sometimes not until much of the steel work is erected.

The construction of the superstructure commences with the erection of the steel work which may progress at the rate of 1,000 tons per week and is handled exclusively by long and powerful derrick booms which command the whole area and the adjacent street, unloading the material as erected. The floors and walls are built simultaneously, while riveting, painting and fireproofing follow close behind. For all of these operations the use of electric power is admirably suited.



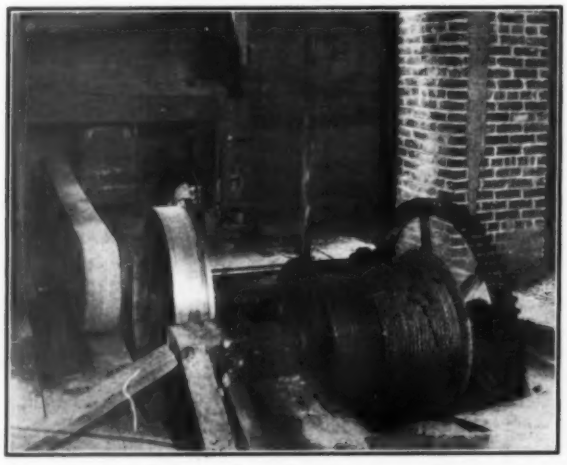
Motor-Driven Concrete Mixer at Rand-McNally Building, Chicago.

Hoisting Motors.

The hoist is the most important apparatus used by the contractor and its uses in building construction are innumerable. The high operating expenses and uneconomical consumption of fuel with steam hoists remove beyond the field of argument any claims for equality, not to say superiority, as compared with electrically driven hoists. Steam hoisting plants are known to be very inefficient but the exact figures are usually difficult to obtain. With an extremely intermittent load on the engine the economy necessarily is very poor. Steam engines must be designed for starting conditions where they take steam under full stroke, and this necessitates their running with an early cut-off when hoisting.

On the other hand the electric system has every advantage which gives it a decided preference for hoist operations. The cost of installation and operation is much reduced and safety devices preventing overwinding and limiting the acceleration are easily provided.

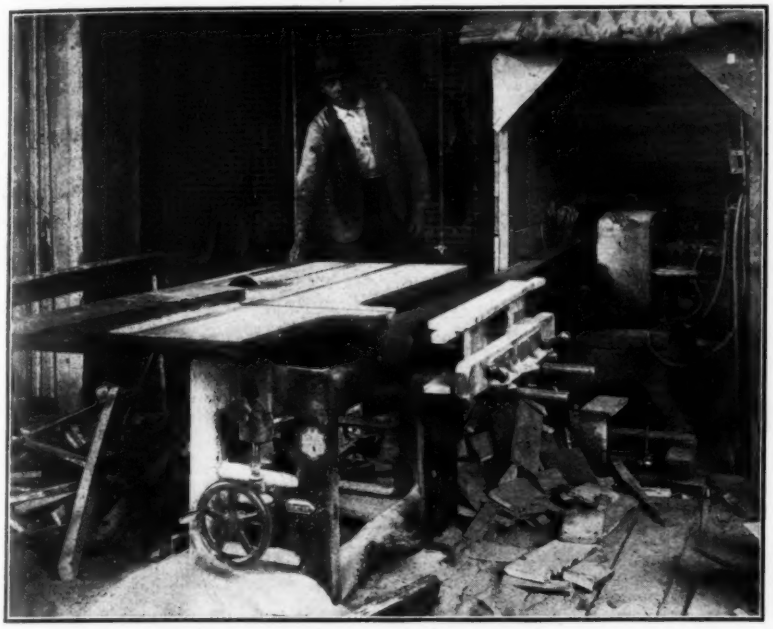
Electric hoists are almost universally driven either by series-wound direct-cur-



Home-Made Electric Hoist Used by Denver Contractor.

Motor-Driven Concrete Hoist at Shubert Theater, Denver.

rent motors, or polyphase induction motors, the characteristics of which especially adapt them to meet the peculiar conditions imposed. With the former, where the service is very infrequent, a comparatively small motor can be used, since in this case, the torque and speed are the determining factors, the question of heating being of secondary importance. Other operating conditions may necessitate a motor being operated so frequently that although the torque and other characteristics may be ample, they are of secondary importance, and the heating of the motor becomes the factor in determining the proper size. Before applying a motor to a given set of conditions, all the requirements must be carefully considered. Owing to the fact that with series motors the speed changes with each change of load, that is, high speeds are automatically secured when the load is light and low speeds when the load is heavy, at light loads it is liable to increase its speed to such an extent that centrifugal forces become dangerously high. Hence it is absolutely necessary to connect this type of motor to the apparatus it drives. In applying series motors, care should be taken that the full-load speed is sufficiently low to insure safe no-load and light-load speeds.



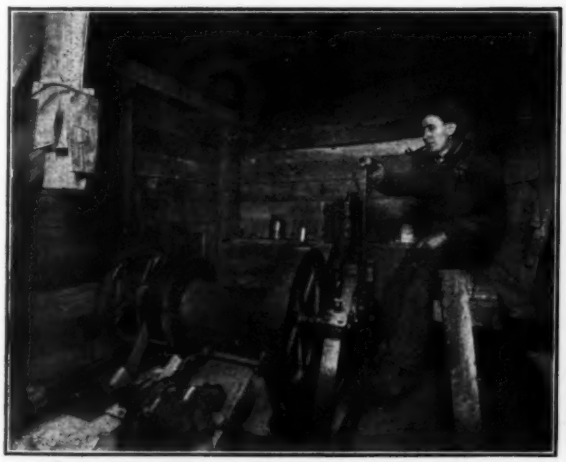
Motor-Driven Saw Used in Building Concrete Forms.

Alternating-current motors of the wound-rotor or slip-ring type are especially suitable for severe intermittent, varying speed, reversing service such as the operation of hoists. Nearly all hoisting machinery requires that the motors be stopped more or less quickly and frequently. To accomplish this a brake of some description must be used. All forms of braking are dependent on friction set up between specially constructed moving and stationary parts. The three most common types are, briefly, as follows: (1) a steel band is used, with wood friction blocks extending around a brake wheel; (2) two rigid supports, hinged at one end and extending vertically on each side of the brake wheel, carry two brake shoes, one on each side of the brake wheel; (3) one or a number of disks attached to the motor shaft are caused to rotate against similar stationary disks. These three types are known as band brakes, post brakes and disk brakes respectively.

There are a great many modifications as to details of the above types. The post and band types are the ones which are used on alternating-current motors. There are a number of methods of operating friction brakes depending mainly upon the amount of energy to be dissipated and the allowable time and frequency of the braking period. The means available are solenoids, air cylinders and hand or foot levers.

There is an increasing tendency to make the operation of all classes of hoist and similar machinery more automatic, which fact means that hand and foot levers are being used much less than formerly. This means further, that electric and pneumatic operation of friction brakes is increasing.

Hoists as used by building contractors may be classified roughly as follows: double-drum hoists, single-drum hoists, double-cage hoists and caisson hoists. Double-drum hoists are used for heavy construction work, such as setting iron and stone, operating cable ways, boom derricks, pile drivers, etc. This type is usually made in sizes of 25, 50, 75 and 100 horsepower capable of raising from 3,000 to 10,000 pounds.



Brick and Mortar Hoist at Rand-McNally Building, Chicago.

Material Hoist at Rand-McNally Building, Chicago.

Single-drum electric hoists are similar to the double-drum types except that they have but one drum and one spool. They are made for lighter service, usually in sizes ranging from 20 to 50 horsepower.

Double-cage electric hoists are specially suited for building construction where material is conveyed in wheelbarrows and hoisted on platforms of suitable size. These machines are, also, usually provided with a winding drum, keyed to the sheave-wheel shaft, which is used for hoisting heavier materials that cannot be hoisted on the cages, such as lumber, doors, window frames, etc. These machines are available in sizes ranging from 10 to 20 horsepower capable of hoisting from 1,000 to 1,200 pounds on the drum at speeds of from 800 for the 10 horsepower to 1,200 feet per minute for the 20-horsepower machine.

Hoisting from caissons up to the present time has been done with the ordinary hoisting engine equipped with governor and cable driving sheaves. A spool is located at each caisson and an endless cable is carried from the hoist sheave around the several caisson spools operating them in series. With this equipment it is necessary that the caissons be either alined or that a combination of sheaves be installed to spring the cable to the proper direction. In this installation a fouled line at any caisson stops all work on the series until the line is straightened or repaired. It not infrequently happens also that the driving cable breaks, with the result that all buckets are precipitated to the bottom and often injuring the workmen. There is another disadvantage in the fact that in the usual work only a part of the caissons are completed at one time and a portion of the plant and workmen must remain idle while the remaining caissons are being finished, or the hoisting from the incompleted caissons must be done by hand.

A wonderful improvement over this is the eight-spool electric caisson hoist which obviates all of the above difficulties. The material from each caisson is hoisted independently. There is no necessity for alinement of caissons as the machine provides a separate hauling line to each caisson and operates with equal facility in any direction. A caisson located at any place in the foundation therefore can be started at any time desired. Since each caisson is operated independently, any breakage or cessation of work does not interfere in any manner with the progress in the other caissons. A slow or difficult caisson, also, does not impede the work in the other caissons. Any hoist speed of load may be had from 0 to 150 feet per minute and the speed is under the absolute control of the operator at the caisson. An accident in any line, therefore, will not affect any other. The hauling line is so carried that it does not slip on a spool and burn out; the slippage is entirely on a friction disk, built for the purpose, and the line and frictions are therefore practically indestructible. One set up on any ordinary size building is sufficient to complete the job. Caissons located as far as 100 feet radius can be operated with ease.

Air Compressors.

Of electrically driven air compressors for serving pneumatic riveters, ejector pumps and other needs likely to arise in the contractor's work there are a number of designs on the market, all of the direct-connected type. With these in service in small units distributed over different sections of the work, wherever they may be needed, the hitherto usual large central steam-driven compressor plant and its requisite long lines of air mains can be avoided, and losses in compressed-air transmission greatly reduced.

Ordinary air chisels require from 25 to 30 feet of air per minute. Piston air drills require from 20 to 40 cubic feet of air per minute, depending upon the size.

The following data are given for motor-driven reciprocating power compressors:

Pounds Gauge Pressure	H.P. of Motor Per 100 Cubic Feet of Free Air Per Minute
25	7.5
30	8.5
40	10.4
45	11.42
50	12.12
60	13.60
70	14.56
80	15.25
90	17.00
100	18.20

Pumps.

Pumps, which like hoists have long formed a staple part of the contractors' outfit, for draining excavations, etc., are now offered for electric motor drive.

The most important advantage of the electrically driven pump is its higher efficiency, this in certain cases being as high as 70 to 75 per cent or from 25 to 40 per cent greater than for steam or air pumps. In the matter of flexibility the merits of electric pumps are the case with which they can be moved from point to point, and the economy of space, which should receive careful consideration in cases where the conditions demand that pumps be placed in the smallest possible room.

The type of pump particularly suited to motor drive is the centrifugal. On excavation work this type of pump is most successfully operated where a sump can be maintained and the water allowed to drain it. When choice must be made between centrifugal pumps driven by electric motors and reciprocating pumps operated by compressed air, consideration shows the centrifugal pump to be more economical. In the former case there are only the losses in the centrifugal pump, motor, and transmission wires, while in the latter case there are the losses in the reciprocating pump, air-pipe line, air compressor and steam engine or electric motor that drives the compressor. The efficiency of reciprocating pumps, such as are used on contract work, may be taken as about the same as that of the best centrifugal pumps for the same work; but it is undoubtedly less when the pistons are worn and when the packing is leaky. The centrifugal pump with few wearing parts runs at nearly constant efficiency for a long period.

Miscellaneous Apparatus.

Concrete mixers, saws, planers and other woodworking machinery, crushers, stone cutters, etc., all can be driven efficiently by electric motors. Regarding concrete mixers, the experience of Aberthaw Construction Company of Boston with all types may be of interest. This company has used steam, electricity and gasoline, but discarded the gasoline engine a few years ago, primarily because of the independability of the engines used, and also because it was difficult to secure in every case a firm base for the engine. The steam engine equipment the company has found has distinct advantages at times, such as cold weather concreting when it is necessary to heat the materials and often thaw around a job.

However, this company prefers electricity when it can be obtained, for the following reasons: (1) The power required on a construction job being intermittent, the saving made when the motor is not in use is considerable; (2) the power is always available on a moment's notice; (3) the motors are portable, easily set up, require small housing, and very little attention; (4) electricity can now be obtained at reasonable figures and the former large expense involved in carrying motor equipment enough to drive with the different types of current used in different cities no longer exists as most power companies rent motors on a reasonable basis.

As to the motors used it may be said that the Aberthaw Construction Company's custom is to arrange its standard four-bag mixer and belted hoist in one group and drive by a 25-horsepower motor. The saw mill containing a split saw, planer, a pendulum cut-off saw, boring machine, and grinder are regularly driven by a 10-horsepower motor. For material elevators a 15-horsepower motor running continuously with a belt shaft which is operated by a rope is used. Where the sand bins have been loaded from a track boot a five-horsepower motor is generally used to run the conveyor equipment. To operate a concrete hoist a 15-horsepower motor is commonly installed if there is one hight in the line. Direct-connected hoists are operated by 22-horsepower units. On the hoist which operates the dump bucket the Aberthaw Construction Company has an additional drum which operates the boom placed on the corner of the concrete tower. For driving its standard mixer, which is a

four-bag machine, 12-horsepower motors are usually set up, but these mixers have been driven with as little as 7.5-horsepower each.

Motor-driven concrete mixers deliver from 1.5 cubic yards to 2.5 cubic yards of mixed concrete per kilowatt-hour consumed. The figure will be found to vary slightly with the length of the motor-operated conveyor used, but as the mixer is the principal load and the hoisting demand is intermittent, the average consumption recorded in mixing concrete has been found by a large user of motor-driven mixers to be about 0.5 kilowatt-hour per cubic yard.

Where the building contractor has much excavation to do, that is in connection with structures which are to cover large ground areas, electric locomotives for hauling dump cars deserve consideration, and may undoubtedly be used to good purpose. Cable ways, also, may be brought into service, and the electric operation of these is well established practice.

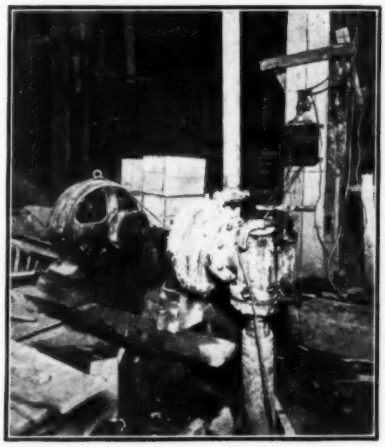
Typical Installations.

In Chicago electricity has superseded steam in all building construction of any magnitude. The principal contractors are all keenly alive to the advantages of electric drive and use it wherever possible. The Commonwealth Edison, upon application, furnishes service to the proposed building line, all work from this point being taken care of by the contractor. In the business district all electric wiring is run underground so that when a contractor requires service the permanent service is supplied to the proposed building if it is to use Edison current. Otherwise, unless current can be obtained from the company's lines in adjoining buildings, the contractor's requirements must be sufficiently large to justify the cost of temporary construction.

The Commonweath Edison Company furnishes current to contractors at the regular power rates, on the basis of yearly service. This rate is 11 cents per kilowatt-hour for all electricity supplied in each month up to and including a consumption equal to 30 hours' use of the consumer's maximum demand in such month; six cents per kilowatt-hour for all electricity supplied in any month in excess of such consumption, up to a consumption equal to 60 hours' use of the customer's maximum demand in such month and four cents per kilowatt-hour for all electricity supplied in any month in excess of said last mentioned consumption; and in any monthly bill whenever the portion thereof that is represented by charges at the six-cent rate or at both the six and four-cent rates, shall exceed $45, the company allows discounts from such portion as follows: Amounts of $50, $100, $150, $200, $300, $400, $500, $750 and $1,000 are entitled to discounts of 10, 15, 20, 25, 30, 35, 40, 45 and 50 per cent respectively.

It would be hard to mention a building of any prominence, erected in Chicago during recent years, in the construction of which electricity has not played a prominent part. At present the number of buildings in course of erection in the business district is the largest in the history of the city, and in every case electricity is used for the majority of mechanical operations.

Several of the accompanying illustrations show motors being used in the new Rand-McNally Building at the corner of Clark and Harrison Streets. The Wells Brothers Company is the general contractor. In the building of this structure 307.5 horsepower in electric motors is at present being used for hoisting, pumping and mixing concrete. When the concrete foundations



Motor-Driven Sump Pump.

were being laid additional motors were used for driving woodworking machines for the wooden concrete forms. The present equipment is as follows: Two 35-horsepower, 700-revolution-per-minute shunt-wound motors direct-connected to two one-yard concrete mixers; two 50-horsepower, 600-revolution-per-minute, series motors operating concrete bucket hoists; two 20-horsepower, 1,000-revolution-per-minute series motors, direct-connected to two brick hoists; one 50-horsepower, 600-revolutions-per-minute, series motor operating a material hoist; one 25-horsepower, 700-revolutions-per-minute motor belted to an 18-inch America rip saw; one 15-horsepower, 720-revolutions-per-minute motor belted to a 16-inch swing saw; and one 7.5-horsepower, 875-revolutions-per-minute motor direct-connected to a centrifugal sump pump.

Another installation that demonstrates forcibly the advantages of electrically driven contractors' machinery is in the Rothschild & Company department store at State and Van Buren Streets. Foundation work for a new building is being carried on in the basement while business is being conducted in the store. Here, it will be seen, even if the difficulties of installing steam engines in the limited basement space could be successfully overcome, the noise and smoke incident to steam operation could not be tolerated. The installation of electrically driven equipment at this job is as follows: Two 10-horsepower, 1,200-revolutions-per-minute, series motors direct-connected to two 600-pound capacity cage hoists; one 20-horsepower, 625-revolutions-per-minute, shunt-wound motor direct-connected to a one-yard Smith mixer; one 20-horsepower, 625-revolutions-per-minute, series motor direct-connected to a single-drum cage hoist; one 20-horsepower, 625-revolutions-per-minute, series motor direct-connected to an eight-spool caisson hoist; and two five-horsepower, 1,200-revolutions-per-minute motors direct-connected to two centrifugal pumps. All motors are 220-volt direct-current machines.

In Brooklyn the use of electricity by contractors is greatly increasing. At present three noteworthy installations are of especial interest. The Edison Electric Illuminating Company of Brooklyn, is and has been supplying power and some light to contractors who are building the subway in Brooklyn, which is an extension to the subway system now in operation in Manhattan. This work is sub-divided among a number of contractors and the service supplied is customarily 230 volts. In one instance, however, where the contractor had 500-volt motors, the company ran 500-volt service for him clear from its substation along the entire length of the route of his work, and he tapped off wherever he wanted power, metering being done at the point on his section nearest to the station. For hoisting work, 15 to 25-horsepower motors are used; for pumping, 10, 7.5 and 5-horsepower motors, and for concrete mixers, 10-horsepower motors. There is not very much lighting in connection with this equipment, but what there is, is done with flaming arcs. There is all told about 500 horsepower in motors used on this job.

The company recently supplied about 1,000 horsepower to the contractors engaged in the construction work in connection with the building of a great government navy-yard dry dock in Brooklyn. In this case 6,600-volt service was supplied to air compressors used in sinking caissons, the motors being from 150 to 250 horsepower each.

Another big contract is one where the Edison Company is supplying current to motor-driven air compressors which are driving shafts for the big Catskill Mountain aqueduct work for the supply of water to Brooklyn. These

shafts are 300 and 400 feet deep, and 6,600-volt service is utilized here. The load-factor on the subway work is very fair on account of the diversity-factor being high. The load-factor in air compressor work is very high, the work being carried on twenty-four hours a day. For the hoisting and pumping work series motors are used; to drive the air compressors induction wound-rotor motors. For the aqueduct work, motors of about 175 horsepower are used, and the metering is done on the high-tension side at the compressors, the company installing the high-tension switchboard and charging customer for it.

In Denver, Colo., the Denver Gas & Electric Light Company has made strenuous efforts to induce contractors to use electrically-operated machinery, and today electricity is used for practically all exterior construction, from the excavating, where motors of from 7.5 to 10 horsepower belted to conveyors are used for elevating the gravel to bins above the street level, where the gravel is loaded in wagons, until the erection of the building is completed. After the excavating, motor-operated concrete mixers direct-connected to motors of 7.5 to 15 horsepower are used for the mixing of all the cement and gravel used in the foundation and reinforced concrete floors. Electric hoists operated by motors of from 3 to 10 horsepower are used for the hoisting of brick, steel, and timber used in the construction of the building.

Where buildings are erected with frame work of steel, motors of from 15 to 25 horsepower are belted to air compressors to provide the necessary air for riveting the sections of steel.

All plumbing work, such as thread-cutting, etc., is usually performed in all large buildings by direct-connected motor-operated machinery.

While direct-current is available for power purposes in all business districts, the company endeavors to persuade contractors to secure apparatus arranged for operation on 220-volt, 60-cycle, single-phase. Motors of this character operate on the "off-peak schedule" and are available for use in either the business or residence sections.

At the new Episcopal Cathedral under construction in the Capitol Hill district the contractor's work was greatly facilitated by the service of a motor-driven stone-cutting plant, including a traveling crane operated by one 7.5-horsepower motor and one three-horsepower motor, and a marble saw driven by a 15-horsepower, 220-volt, three-phase induction motor. The absence of a steam-driven plant was much appreciated by the residents of the district surrounding the structure, and further advantages accrued to the contractor through the facility with which marble was cut and handled upon the ground, much time being saved through the use of electrically driven apparatus. A temporary transformer installation supplied energy to the motors from the regular distribution circuits of the company. A prominent contractor owns two concrete mixers operated by 15-horsepower and 10-horsepower motors of the single-phase, 220-volt type, a bucket conveyor for concrete, driven by a 7.5-horsepower direct-current motor, a circular rip saw driven by a 6-horsepower direct-current motor and a three-horsepower hoist of the Chattanooga type. A prominent electric supply company has five brick hoists, each driven by a 7.5-horsepower single-phase motor, and these are in constant use at a rental of $1 per day apiece.

Electric energy is being used in the erection of the new post-office building, there being in operation a 20-horsepower sand screen and a 20-horsepower marble hoist, the motors being of the 550-volt direct-current type. In the erection of the new First National Bank Building a 30-horsepower concrete mixer and a 7.5-horsepower brick hoist were used. In the work on the new Foster Building a 25-horsepower air compressor, a five-horsepower brick hoist and a 15-horsepower concrete mixer were operated. Three concrete mixers, each driven by a 10-horsepower, 220-volt, three-phase induction motor, were used on the new Tramway Building, with a circular rip saw and planer driven by a five-horsepower motor, and the work on the new Daniels & Fisher Building and tower was facilitated by the use of a 25-horsepower air compressor, a 15-horsepower concrete mixer, a five-horsepower rip saw and a five-horsepower brick hoist. All the steel members of the framing of the new Chamber of Commerce Building were elevated by a 7.5-horsepower electric hoist, a 15-horsepower concrete mixer and a three-horsepower brick hoist also being used on this work. As a rule the contractors leave the making of connections to the company. In the finishing trade seven hardwood floor planers of the motor-driven type are in operation. Each is driven by a three-horsepower, 220-volt, single-phase motor and a watt-hour meter is placed on each machine. A meter reader is sent by the company each month to the place where any given machine is at work. The labor cost of floor finishing is cut about 60 per cent by these devices, which are portable, and which perform their work far more rapidly than is possible by hand and without the unpleasant noise of the hand-planer. Three of the accompanying illustrations show electrically-driven apparatus recently used in Denver.

During the past year the Edison Electric Illuminating Company of Boston (Mass.) has had connected to its lines upwards of 1,000 horsepower for temporary constructing purposes.

The largest installation of electrically operated building contractors' appliances that has been connected to the Boston Edison system is now in use by Norcross Brothers Company in remodeling the Custom House. Owing to the depth of the foundation necessary to carry the tower of the new structure, it was found necessary to use compressed air for the purpose of keeping the excavation free from water. The air forced in on the cassion principle, the air pressure keeping the water back.

One 100-horsepower, 220-volt direct-current, motor belted direct to two compressors has been in continuous operation day and night since March, 1911. From March, 1911, until September, 1911, the kilowatt-hour consumption averaged 21,000 kilowatt-hours per month; the maximum demand being 71 kilowatts. General use has been made of electrically operated hoists, derricks and concrete mixers on this structure.

In the construction of the Copley-Plaza Hotel, Copley Square, the George A. Fuller Company, general contractors, have in service a rather complete equipment. The detailed installation is as follows: One concrete mixer, operated by a 25-horsepower, 220-volt, direct-current, shunt-wound motor geared directly to the mixer. This mixer has a capacity of approximately 300 cubic yards per day of nine hours. Motor operates at practically full load. One Lambert single-drum hoist, operated by a 25-horsepower, series-wound, 220-volt, direct-current motor with a standard, drum, variable-speed controller. One Maine Electric Company double-drum hoist operated by a 50-horsepower, 220-volt, series-wound, direct-current motor, equipped with the usual type of drum controller. The motor handles with ease and rapidity steel girders weighing from 16 to 18 tons. One Ingersoll-Sargeant air compressor, operated by a 30-horsepower, 220-volt, direct-current, shunt-wound motor, directly connected; air being supplied at 80 pounds' pressure for a large variety of pneumatic tools which are used for riveting, chipping, and drilling steel work, and for surfacing concrete. One 7.5-horsepower motor belted direct to a 12-inch circular saw. This outfit is moved about from floor to floor, and proved to be a great convenience for the various line of carpenters' work necessary in the building.

The first motor was installed on the work June 11, 1911, and as the work progressed others were added, until in October 1911, when the steel frame

was practically completed and the work of filling it was begun; the installation totaled 137 horsepower. The kilowatt-hour consumption from October 1 to February 2, inclusive, was 11,910 kilowatt-hours, averaging 2,382 kilowatt-hours per month. The maximum demand obtained from the readings of the Wright demand indicator, for the same period, was 39 kilowatts. The average demand for the period previously mentioned was 33 kilowatts or 32.6 per cent of the connected load. The George A. Fuller Company has at the present time in process of construction in Boston, a large addition to the South Terminal Station, also remodeling the Suffolk County Court House in Pemberton Square, and is constructing a 12-story office building, known as the Minot Building, 113 Devonshire Street. General use is being made of electric hoists, concrete mixers and electrically operated pumps in all of the above mentioned buildings.

In the construction of the Peter Brigham Hospital there are 16 buildings and approximately 3,000 linear feet of concrete retaining wall 12 feet high and 20 inches in thickness at the base. All concrete used in the building of this wall and for the foundation work upon the buildings, was mixed with a 35-horsepower, direct-current, 220-volt motor-driven mixer. This mixer has a capacity of 325 cubic yards per day of eight hours. The 35-horsepower motor that operates this concrete mixer was installed in October, 1911, and has been on the Edison service for three months. The kilowatt-hour consumption varied from 630 to 980 per month; the maximum demand being 16 kilowatts. As the work progresses upon these buildings later on the Wells Brothers Company will install a 35-horsepower motor-driven air compressor. This compressor will supply air to pneumatic surfacing tools, as the entire 3,000 linear feet of concrete wall, several thousand feet of granolithic sidewalk, and much of the exposed concrete work of the buildings is to be surfaced.

In the construction of Section 2 of the new Cambridge Subway by Coleman Brothers, contractors, electricity has been utilized to good advantage in the operating of hoists, pumps, conveyers and for lighting. The construction of Section 2 had many interesting applications of motor-driven machinery. The main shaft of the tunnel was sunk on Boston Common nearly opposite the State House. From this shaft excavating was begun and the tunnel carried directly under Beacon Hill. One 25-horsepower motor-driven "winch hoist" was installed in this shaft. As the excavating progressed the dirt was brought to the shaft, hoisted to the surface and deposited directly on a belt-conveyer, carried some 165 feet to a convenient location for loading upon teams to be carted away. The belt conveyer was of the bucket type, and the entire outfit, including the necessary gearing for the belt, idlers, etc., was operated by a five-horsepower, 220-volt, direct-current, shunt-wound motor. In order to keep the tunnel free from water, three three-inch centrifugal pumps each operated by a 15-horsepower, 220-volt, direct-current motor were installed. These pumps were located at various points in the tunnel and were automatically controlled by means of float switches. This installation totaled, approximately, 80 horsepower, the kilowatt-hour consumption varying from 690 to 1,000 per month; the maximum demand being, approximately, 31 kilowatts. Temporary lighting for the constructing of this Section consisted of 200 fifty-watt lamps wired in clusters and moved along as required.

Many of the contractors who have constructed sewers for the city of Boston have used motor-driven pumps for the purpose of keeping the excavations free from water during the progress of the work. These contractors usually apply for Edison service for motors from 20 to 30 horsepower in size. The common practice is to belt direct to a centrifugal pump located on a platform over the drainage well, the location planned so that the lift is usually from 20 to 25 feet. In cases of extreme depth of well, the motor and pump are often suspended in the well to the necessary depth. Either automatic or hand-control can be attached to this type of installation. Where direct current is available, the automatic feature is usually given the preference.

The following data are illustrative of the average conditions met with in this class of work: **Installation No. 1**—One 30-horsepower, 220-volt, direct-current, shunt-wound motor belted to a six-inch centrifugal pump operating at 550 revolutions per minute, has a capacity of 1,200 gallons per minute. Motor is automatically controlled by means of a float switch. The installation has been in service for three months. Kilowatt-hour consumption averaged 2,500 per month; the maximum demand being 16.5 kilowatts. No information obtainable as regards the number of gallons of water pumped, except as to the pump capacity, previously mentioned.

Installation No. 2—One 25-horsepower, 220-volt, 60-cycle, three-phase motor belted to a six-inch centrifugal pump. This installation was on the service for five months. The kilowatt-hours per month varied from 360 to 2,460. Maximum demand 21.5 kilowatts. The variation in kilowatt-hour consumption may be accounted for by the difference in weather conditions.

UNDERGROUND-CONDUIT CONSTRUCTION BY A LARGE RAILROAD.

By Harold K. Weld.

One of the most interesting of recent permanent improvements made by the steam roads entering Chicago, is the extensive installation of underground electrical conduits now in progress on the right of way of the Pennsylvania Railroad. When this work is completed, all wires on this road will be underground between the Union Station and East Side, South Chicago, a distance, via the right of way, of fifteen miles.

This removal of all aerial conductors from the ever present hazard of interference and serious damage by storms, foreign high-tension currents, etc., will result in a great advance in the safety and reliability of the system in this zone of heavy traffic with trains running on close headway.

The underground system provides ducts for signal, telephone, telegraph and low and high-voltage lighting and power wires. A liberal allowance in spare ducts has also been made for the future installation of such additional cables as may be required, and for which the need cannot at the present time be definitely foretold. In addition to the spare ducts already installed, provision is made for the location of future ducts, as shown upon Fig. 3.

Throughout the installation, a commendable policy has been adopted of segregating the different classes of circuits, and strictly isolating them by providing separate manholes and junction boxes for each set of cables. In this manner, the wires of the signal system appear only in the signal manholes and are by-passed around the manholes of the telephone and telegraph circuits. These, in turn, are by-passed around the light and power manholes, and, in this manner, is eliminated any confusion which might exist if high and low-tension cables of the several classes of service were to appear in the same manhole.

The Pennsylvania Lines entering Chicago constitute two distinct roads, the Pittsburgh, Fort Wayne and Chicago Railroad and the Pittsburgh, Cincinnati, Chicago and St. Louis Railway. The two leave Union Station in different directions, but both run south, and at Englewood there is a connecting line between them.

In the portion of the work between the Union Station and Engelwood, where the P. C. C. & St. L. conduit is for its own wires only, the ducts are located close to the retaining wall and at a depth of approximately three feet below the base of the rail. For the

greater part of this distance the line consists of a six-duct multiple conduit, laid on edge, and a four-duct multiple conduit, which are laid with a separation of approximately three feet. The six-duct conduit is laid against the retaining wall, which forms protection on one side, and is incased in an envelope of concrete, four inches thick on top and side, and six inches thick at the bottom. The envelope surrounding the four-way conduit, buried in the sub-grade three feet from the six-way, is of similar thickness.

In excavating the trench, care was taken to give a slight uniform gradient so as to enable ducts to drain to the manholes. After thoroughly tamping the 1:3:6 concrete base, this was allowed to set. The multiple conduits were then placed, using two steel dowel pins at each joint to preserve alignment. At all joints, strips of burlap, six inches in width, were wrapped completely around the tile as a safeguard against the entrance of concrete into the ducts. Where several conduits were laid together, the joints were staggered and regular fractional-length pieces were used to make ends flush at the manhole entrances.

Owing to the fact that practically all of this work is upon an elevation, the conduit line crosses a large number of city streets on the railroad bridges. Fig. 1 shows details of the manner in which the conduits are buried in the structure of the concrete of the bridge. The photograph shown in Fig. 2 also clearly illustrates this method of construction, although taken at a different point. Laterals are run from manholes at all bridges over city streets, to furnish current for the electric lighting of these subways.

Between Englewood and East Side, a distance of eight miles, the Lake Shore & Michigan Southern Railway parallels the Pittsburgh, Fort Wayne & Chicago right of way and is immediately adjacent. For the entire distance, the conduit line has been built jointly by the two companies, each company having separate duct lines built in the same trench, there being a separation of eight inches of concrete between the conduits of the two roads.

Fig. 3 shows an end elevation of the joint conduit line located along the intersection of the rights of way of the two companies, the center of the line being approximately ten feet from the centers of the adjacent sets of tracks. The drawing shows clearly the present P. F. W. & C. high-tension and low-tension ducts, which are separated from each other by six inches of concrete, and also the present L. S. & M. S. low-tension ducts separated from the P. F. W. & C. by eight inches of concrete.

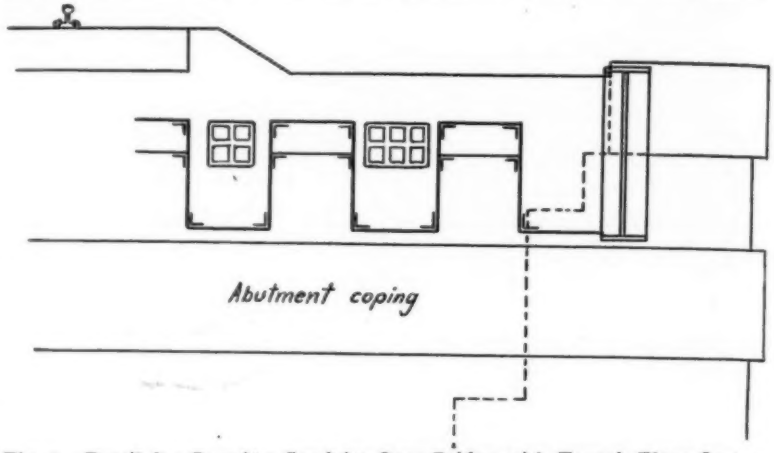


Fig. 1.—Detail for Carrying Conduits Over Bridge with Trough Floor System.

Fig. 2.—Conduits Embedded in Bridge Structure.

The design and construction of the manholes is perhaps one of the most unique and interesting features of the entire installation. Fig. 4 clearly shows the method by which the three classes of service are segregated, so that little opportunity for any confusion can arise in the minds of the workmen engaged in new installation of cables or in the work of maintenance or repairs. The same relative positions are maintained throughout, viz: "A" P. F. W. & C. high tension; "B"—P. F. W. & C. low tension; "C"—L. S. & M. S. low tension; and this enables a man to be assured at a glance that when opening a certain manhole he will find the particular cables with which he wishes to deal, and no cables of the other classes of service.

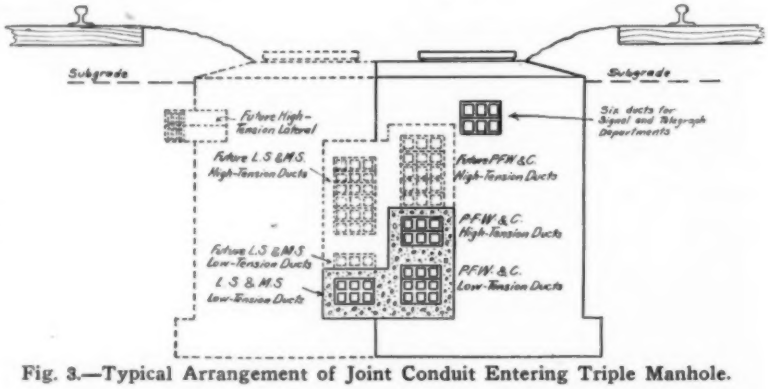


Fig. 3.—Typical Arrangement of Joint Conduit Entering Triple Manhole.

These manholes are built of concrete, with bottoms twelve inches thick and walls nine inches thick. They are reinforced in bottom, sides and top by means of three-quarter-inch corrugated steel, laid twelve inches between centers.

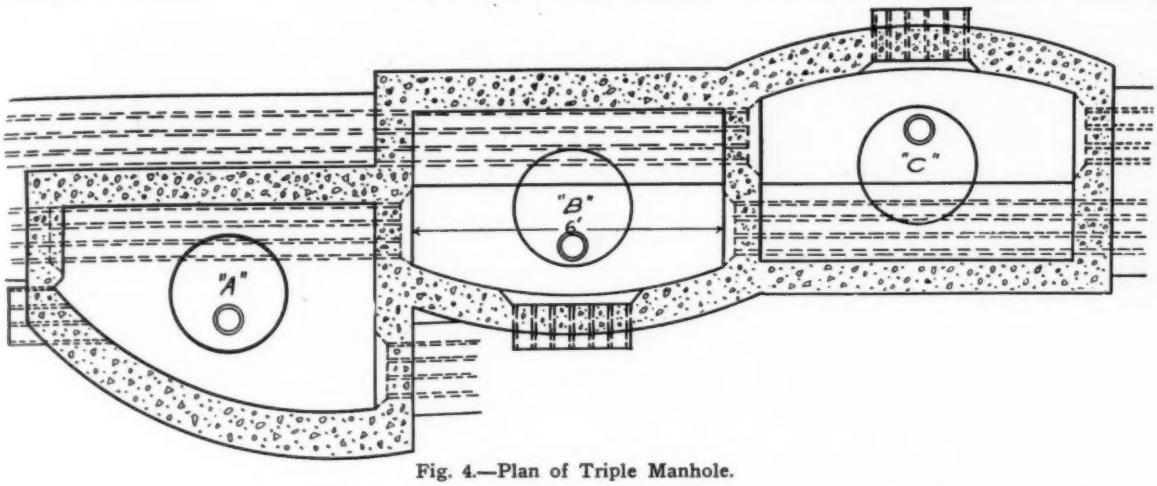


Fig. 4.—Plan of Triple Manhole.

Each manhole has a separate vertical drain tile set in the floor to allow escape of any water entering the manholes, and a one-inch galvanized-iron pipe is driven vertically through this tile to provide a suitable ground connection for electrical purposes.

Fig. 5 is a plan view of typical P. C. C. & St. L. double manholes, showing the method of by-passing through one manhole wall the ducts which open into the adjacent manhole.

In the construction of all manholes the ultimate future number of ducts are built into the walls and the spare ones plugged until such times as they are needed. In general, multiple vitrified-clay conduits are used for the low-tension wires of both companies and single vitrified-clay conduits for the high-tension circuits, although this practice is subject to a few exceptions in which it was decided to use multiple ducts also for the high-tension circuits.

It is well to note the use of round manhole covers, in preference to the rectangular type. The danger in the use of the rectangular cover is the possibility of its accidentally falling through the opening when being removed or replaced, and causing serious damage to cables or apparatus in the manhole. This risk is eliminated in the use of the round cover.

The writer wishes to make acknowledgment of the courtesy of engineers of the Pennsylvania Lines in supplying data necessary for the above account, and also of the McRoy Clay Works, Chicago, who manufactured the vitrified-clay conduits used in this interesting piece of underground construction.

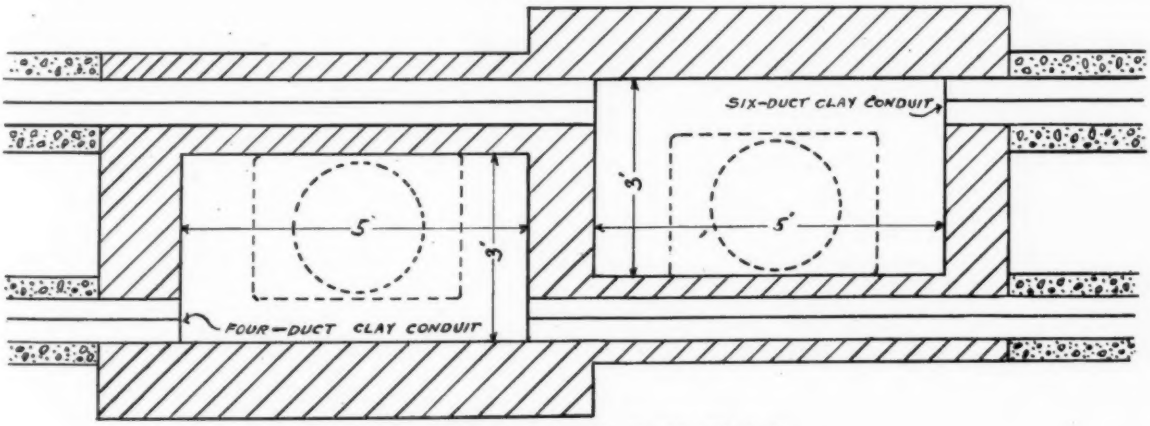


Fig. 5.—Plan of Panhandle Double Manholes.

Wireless Conference.

An international convention on wireless telegraphy will be held in London, beginning on June 4. It is hoped that the conference will result in international control of the various systems of wireless telegraphy. This will be only the second wireless conference yet held, the first having been held in 1906 in Berlin. Wireless telegraphy has made great strides since then and many new problems have arisen for consideration.

The conference will endeavor to come to a decision on all questions affecting the regulation of wireless telegraphy. In 1906 the only subject dealt with was marine communication. Now shore-to-shore communication will have to be taken into consideration.

Electrification Urged in Cleveland.

It is announced that Director Springborn and Mayor Baker intend to try to force the railroads entering Cleveland to abandon the use of coal within the city limits and to use electric locomotives. Baker and Springborn have been collecting data on the subject, and Mr. Springborn said that as soon as Smoke Inspector Roberts has completed the organization of his office he will be put in charge of the campaign against the railroads. Several unsuccessful attempts to force electrification of the roads have been made by city officials during a period of several years.

Commercial Practice
Management, Rates, New Business

Commonwealth Edison Company to Reduce Rates.

On April 1 the Commonwealth Edison Company, of Chicago, will reduce the primary portion of its lighting rates from 11 cents to 10 cents. The company also announces that on October 1, 1912, the secondary or low-rate portion will be reduced from six cents to five cents.

This reduction, which is entirely voluntary on the part of the company, is in accordance with its policy of reducing rates whenever earnings have reached a point sufficient to pay fixed charges and fair dividends. In this connection it is interesting to note that reductions have been made every year, save one, since the year 1905, and in the seven years intervening a total reduction of 50 per cent has been made in lighting rates.

The schedule of reductions for the period mentioned is as follows:

YEAR	RATE	
	Primary	Secondary
1905	20	10
1905 (July 1)	16	10
1906	14	10
1907	14	8
1908	12	7
1909	12	6
1911	11	6
1912 (April 1)	10	6
1912 (October 1)	10	5

Central-Station Steam Heating for Louisville.

An ordinance has recently been introduced in the general council of Louisville creating a franchise for the supply of steam heat in the downtown section of the city. The ordinance provides the following rates: $1.00 per 1,000 pounds for less than 2,500 pounds of condensation and 50 cents per 1,000 pounds for excess. The flat rate is based on the required condensation, not to exceed 40 cents per square foot for the heating season.

The Kentucky Electric Company is responsible for the introduction of the ordinance, having circulated a petition in favor of the franchise among the business men of the city. A point emphasized in the petition is the great reduction in the smoke nuisance which will result if the many isolated plants are abandoned.

Rates Cut in Oakland.

The Central Oakland Light & Power Company has announced a reduction in the rate for residence lighting from seven to six cents per kilowatt-hour.

A. T. Macdonald.

Even a casual inspection of *Chained Lightning*, the famed house organ of the Louisville (Ky.) Lighting Company, will leave with the reader the conviction that its editor is a true "newspaper man" in every sense of the word. So thoroughly does this little publication fulfill its mission that several central-stations, in no way connected with the Louisville Lighting Company, have arranged to distribute it to their customers, and the possibility of syndicating on a much larger scale is being seriously considered.

The editor of *Chained Lightning* is A. T. Macdonald, general sales manager of the company. Like his chief, George H. Harries, president, Mr. Macdonald is a graduate of the newspaper business. He saw service on the big dailies of New York and Chicago, as well as in Denver and Louisville. He was managing editor of one of Frank Munsey's metropolitan newspaper properties, and later scored a big success in the same capacity on the Louisville *Herald*. He created a column of human interest and personal expression called "Wait-a-Minute," which won fame all over the country and was copied by hundreds of other papers.

A. T. Macdonald,
General Sales Manager, Louisville Lighting Company.

In 1907 Mr. Macdonald served as president of the Greater Louisville Exposition, held in the First Regiment Armory. This was given under the auspices of the Louisville Commercial Club, of which he was a director. So great was the success of the undertaking that shortly after, when R. E. Hughes, secretary of the Club, resigned to become president of the Kentucky Electric Company, of Louisville, which was just starting in the field, Mr. Macdonald was unaimously chosen to succeed him. After that he managed the Southern Electrical Exposition given under the auspices of the Club in Louisville, coming in close touch with the electric interests of the section in that way. Shortly thereafter he accepted the position of assistant to the president of the Citizens' National Life Insurance Company of Louisville; and later was offered the post of traffic manager of the Louisville Lighting Company, which he accepted.

Mr. Macdonald has met with marked success in that work, and has aided in giving the company a personality and influence which it is perhaps safe to say it never had before. As already stated, one of the big features of his work has been *Chained Lightning*, a monthly publication issued in the interest of the company, but which treats of many electrical subjects from the popular standpoint.

Since being appointed to his present position of general sales manager, Mr. Macdonald has succeeded by the use of aggressive methods and careful selection of his soliciting staff in putting a large amount of new business on the books of the company. He is continuing to edit *Chained Lightning*, but is giving most of his attention, as indicated by his title, to the selling end of the business, working in conjunction with General Manager Glidden.

"Night in Little Rock."

This is the title of an attractive booklet which the Little Rock Railway & Electric Company, Little Rock, Ark., is distributing to its patrons. It contains 14 views of street and sign lighting in Little Rock and indicates the extent to which merchants employ electrical advertising. The pages measure 6 by 9 inches.

Central-Station Power for Box Factory.

The Norman Lumber & Box Company, Louisville, Ky., manufacturer of wooden boxes, has contracted with the Louisville Lighting Company for 175 horsepower in motors. Individual drive will be used throughout.

A Few Facts Relating to the Progress Being Made in the Electric-Vehicle Field.

The electric-vehicle campaign in Boston is raging. The Edison Electric Illuminating Company has to date spent $104,424 in the purchase and exploitation of the electric vehicle. It now operates 34 electric vehicles and is changing over its entire equipment of horse and gas machines to electric vehicles. It has an active and efficient electric-vehicle staff getting business. It operates a public garage and electric-vehicle signs, and advertises extensively.

The Public Service Electric Company of Newark, N. J., is spending money freely in the development of the electric-vehicle business. It offers the manufacturer the use of a large office building, furnishing rent, light, heat, janitor service and electric signs free. Directly and indirectly it has caused the sale of nearly one hundred electric vehicles within the last ten months.

The following is a list of a few users representing an investment of about $5,000,000 in electric vehicles in operation and on order:

	Number of Cars.
Adams Express Company	250
United Dressed Beef Company	22
American Express Company	106
Case & Martin Company	100
Gimbel Brothers	96
New York Edison Company	95
Ward Corby Company	64
Frederick Loser Company	26
Rochester Railway & Light Company	52
H. B. Claflin & Company	23
Ward Baking Company	200
General Electric Company	44
Siegel, Cooper Company	15
George Ehret Company	42
R. H. Macy & Company	39
Public Service Electric Company	12
Commonwealth Edison Company	29
Independent M. & D. Service	24
Central Brewing Company	14
J. Taylor Dry Goods Company	10
Chapman Sacks Company	13
F. A. Poth & Sons	24
Rio de Janeiro Tramway Company	10
Abram & Straus Company	20
Tiffany & Company	21
Marshall Field & Company	18
United Electric Light & Power Company	10
Motor Delivery Company	26
Gambrinus Brewing Company	12
Arnold, Constable Company	16
Peter Doelger Company	31
Swartzchild & Sulzberger	20
H. C. Piercy Company	43
Edison Phonograph Company	15
Jacob Ruppert Company	42
C. Schmidt & Sons	13
Edison Electric Illuminating Company	34
James A. Hearn & Son	35
Sulzberger Sons Company	19
New York Butchers' Dressed Beef Company	13
Anheuser Busch Company	57

The United States Government has in use upward of 75 electric trucks.

It was after a searching investigation that the American Express Company recently placed orders for over 80 electric rigs—only a beginning.

Ninety-five per cent of all the commercial electric vehicles installed during the past eight years are successfully operating, while several installations show over fifteen years of actual service.

Large electric-vehicle and accessory factory extensions are now under way in many quarters. Could better endorsements be conceived?

The growing demand, it is safe to predict, will, within a few years, assume tremendous proportions, coming, as it will, from all the public-service corporations, from all branches of mercantile lines, including transportation companies and express companies, and for municipal use under the following departments: street cleaning and removal of garbage; fire trucks and service wagons; police patrol and ambulance, hospital ambulances, and service wagons.

Every central station can add to its dividend-earning capacity by advocating the use of electric vehicles. "More current will soon be sold for electric-vehicle charging than we are now selling for light" is the statement of one of the largest and most conservative central stations in the East.

The Publicity Committee of the Electric Vehicle Association of America is now preparing a program for the press. Work of starting branches of the Association is being actively pushed.

Central-Station Business in Independence, Kan.

Securing power business at the rate of one horsepower a day for a period of three years is the record of the Kansas Gas & Electric Company, of Independence, Kans. Independence is a town of 10,000 inhabitants. One of the interesting installations, is that in a brick yard, a total of 250 horsepower in motors being installed. W. R. Murrow, manager of the central station, states that this was the first brick yard in the country to be equipped with motors. Another interesting installation is that in the Uhrich planing mill, a total of 227 horsepower in motors being installed. Individual drive is used throughout. The aggregrate power load is 1,000 horsepower.

In the matter of electric vehicles the Kansas Gas & Electric Company has also shown great activity, there being at present 30 electric vehicles in service. In every case the user provides his own charging equipment.

Montgomery Gets Low Lighting Rate.

The contract for lighting the streets and public buildings of Montgomery, Ala., for a period of ten years beginning January 1, 1913, has been awarded to the Montgomery Light and Water Power Company by the City Commission. Under the agreement the company is to light the thoroughfares of the city with four-ampere flaming or magnetite arcs at an annual cost to the municipal government of $22.50 a lamp.

New Directors for St. Louis Central Station.

Three new directors have been added to the board of the Union Electric Light & Power Company of St. Louis. A. C. Einstein, recently chosen general manager of the company, is one of the new directors and also first vice-president. He takes the place of Alten S. Miller on the board. The others are H. H. Pierce and George R. Sheldon of New York.

The addition of this new blood, it is expected, will give impetus to the progress and development which have signalized the company in the past.

Besides the changes in the directorate of the company, several were made also in the personnel of its officers at the annual stockholders' meeting. J. D. Mortimer continues as president, with Mr. Einstein as the next in command in St. Louis. Breckinridge Jones is second vice-president; Festus J. Wade succeeded James Campbell as third vice-president, and Herman Spoehrer was re-elected secretary and treasurer. The directors who hold over are Julius S. Walsh, James Campbell, Breckinridge Jones, Festus J. Wade, Adolphus Busch, H. N. Davis and J. D. Mortimer.

Free Delivery of Lamp Renewals in Milwaukee.

On January 1, the Milwaukee Electric Railway & Light Company inaugurated a system for the free delivery of lamp renewals to all lighting customers. The city is divided into three districts and delivery is made in each two days each week. The company requires the customer to send in a requisition for the lamps desired three days in advance of delivery days specified for each district.

Some Interesting Figures.

The following figures were compiled recently by one of the electric-vehicle journals: During the last five years the cost of oats has increased 11 per cent, the cost of corn has increased 16 per cent, the cost of hay 24 per cent, and the cost of horses 100 per cent. Within this period the cost of electric vehicles has decreased remarkably and the efficiency of the electric truck has increased 25 per cent.

City Pays for Lighting Verandas.

The City Council of Mt. Cory, Ohio, has adopted a unique method of lighting the streets of the town. As an inducement the city will pay for all electricity used by its citizens on verandas and in front yards. For the purpose of defraying expenses of erecting poles and stringing wires, bonds of the municipality will be issued.

Electrical Construction

DEFECTIVE GROUNDING CAUSES LAMPS TO BURN OUT.

By F. G. Waldenfels.

Many central stations follow the practice of grounding the neutral of the secondaries of transformers, and a common way of making the ground is to connect the ground wire to an iron pipe driven into the earth at or near the foot of the pole on which the transformer is installed. While grounds thus made may be very poor if the work is not carefully done, the method is far superior to some other systems of grounding sometimes employed—for example, to that of grounding to the guy wire of the transformer pole, which is sometimes resorted to. An interesting case of the latter kind came to the writer's attention not long ago in his work as an electrical inspector.

In this instance, a house had been wired in what was considered the most approved way. Sherardized conduit had been used throughout and neither pains nor money had been spared to secure the very best workmanship and material available. At its completion both the property owner and the electrical contractor were very proud of the job. The circuits all tested free of shorts and grounds, and when the service was connected everything went well for a time. It developed, however, that on windy days plug fuses in the house would blow and all the lamps on some of the circuits be burned out. This trouble continued for about six months, during which interval both the electrical contractor and representatives of the central station made several unsuccessful efforts to determine the cause of it. Finally the property owner notified the inspection department of the local Board of Fire Underwriters, and one of their inspectors was sent to make an investigation. After considerable work this inspector found that the disorder was due to the manner in which the neutral of the transformer was grounded and to a leak between the primary and the secondary windings. As shown in the accompanying figure, the neutral was grounded to the guy cable of the transformer pole and the cable was attached at the lower end to an anchor by means of a couple of links, one in the cable and the other on the anchor. During high winds this link connection would be loose part of the time, thus breaking the circuit to ground, and it was then that the high-voltage current leaked into the lamp circuits and caused the disturbances described.

The transformer was replaced with a new one and a ground circuit made to a pipe driven into the earth for the purpose. Thereafter there was no further trouble.

Fundamentals of Electrical Contracting.

At a noonday talk of the Electrical Association of Quebec, Montreal, November 16, J. H. Lauer, secretary of the Builders' League, spoke on some fundamental principles affecting the business of contractors. There was, he asserted, no such thing as luck in contracting; there were certain principles which, carried out thoroughly, must mean success. Touching upon the accounting end, he said that many looked upon this as of little importance, but it was a great mistake. The greatest number of business failures in the United States and Canada occurred among contractors and the reason was that the firms did not sufficiently look after the accounting side. A mistake was often made in figuring upon the cost of labor; they calculated that the men would do a larger amount of work than could reasonably be expected and he had known instances where labor had cost 20 per cent more than had been estimated upon. Mr. Lauer insisted upon the necessity of personal energy and the importance of reputation; one without the other was of little avail. They must remember that the owner who was looking to build had a very shrewd idea of the reputation of the contractor to whom he was going to give the work. It was all very well to say that the work would go to the lowest bidder, but they knew that the reputation of the contractor was a vital factor in the awarding of the work. Some contractors looked upon advertising as a dead loss; this was a mistaken notion. They must keep themselves before the public as reputable contractors, and when once their reputation was established they must justify it by good work. The man who was looking to do cheap work was not the man who would succeed in the end.

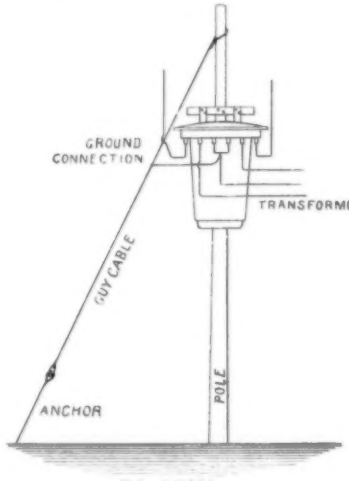


Diagram Indicating Defective Ground.

With regard to such associations as theirs, they were often looked upon as combinations to fight labor, and this he regarded as a wrong aspect. Referring to the importance of fixed charges in conducting business Mr. Lauer alluded to some recent labor troubles in the plumbing business in Montreal, the outcome of which was an agreement to add a definite percentage for overhead charges. One question which the Electrical Association had to consider was how to get and keep a better class of electrical mechanics. The city had the name of offering the cheapest inducements to the wage-earner in the electrical trade on the continent. The men here were paid on an average from 25 to 30 cents per hour, while in the States the average was from 40 to 45 cents. This made it hard to get good men. Then, too, there was the question of apprentices, who were paid from $3.50 to $4.00 per week the first year to $6.00 in the third year, if they stayed during the latter year; $5.50 if they changed. They could not expect to attract young men under such circumstances. There was in these days a lack of sympathy between the men and masters, and there was an ever-widening breach between the employed and the employers. There must be an earnest endeavor to get back to the personal relationship which formerly existed between the two.

He suggested that electrical contractors should follow the example of the

plumbers and raise their status by obtaining recognition from the civic authorities. No plumber could do work without passing an examination, whereas anyone could do wiring and call himself an electrical contractor. Many fires were due to defective wiring caused by want of knowledge on the part of people doing the work, and if the status of the electrical contractor was recognized this would, in a measure, be remedied.—*The Electrical News.*

Among the Contractors.

George F. Rohn, electrical contractor, 446 East Water Street, Milwaukee, Wis., is making some additions to the electric lighting and power plant of Library Museum, in Milwaukee.

Childers & Waters, 108 North Fourth Avenue, Louisville, Ky., electrical contractors have secured the wiring contract for an installation of 130 horsepower in motors to be made in the stove works of Bridgeford & Company. Work will be started immediately.

R. T. Sayre, of East Liverpool, O., has been awarded the contract to install three 20-horsepower, three-phase motors for the Smallwood Stone Company of Empire, O. Two motors will be used on the hoist and the third on the stone lathe. The contract means that electric current will entirely supersede steam power.

In response to the general demand for scientific illumination, the Electric Construction Company, of 185-189 East Fourth Street, St. Paul, Minn., announces the establishment of a department of illuminating engineering. The department is under the direction of Arthur L. Abbott, illuminating engineer, who is assisted by Clovis M. Converse.

C. E. Stagg, one of the leading electrical contractors of Peoria, Ill., who was lately president of the Associated Electrical Contractors of Illinois and is now a director of the National Contractors' Association, is doing the electric wiring in the new building of the Young Men's Christian Association in Peoria.

The Home Electric Company, 134 South Third Street, Louisville, Ky., electrical contractors, are at present busily engaged on a number of important jobs. These include the Gutman department-store building, a five-story structure at the corner of Fourth Avenue and Walnut Street, the Cohn shoe-store building, 346 Fourth Avenue, and a nine-story store and office building located at Fourth Avenue and Market Street.

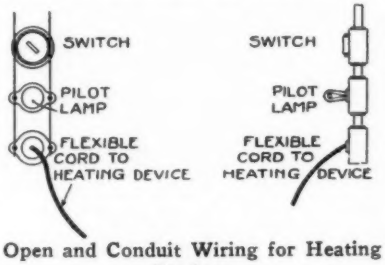
NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

Wiring for Electric Heating Devices.

The great increase in the use of electric heating devices during the past few years and the still greater increase that can safely be predicted, makes pertinent some remarks relating to the wiring required. Many new residences and apartments have special circuits with wall and base plugs located at various locations for operating heating devices and also small portable electric motor-driven devices, as vacuum cleaners, washing machines, and so on.

Radiators, stoves, water heaters, vacuum cleaners, tailor's-goose irons and the larger sizes of laundry irons should not be connected to the ordinary fixture socket. Receptacles and plugs of sufficient current-carrying capacity should be provided. The ordinary separable attachment plug has a rating of 660 watts, 250 volts, so that



Open and Conduit Wiring for Heating Devices.

for irons and other devices taking no more than 6 amperes on 110-volt circuits, these plugs are approved. Standard key or pull-chain brass-shell sockets with slow make and break, as used on fixtures and for pendants, are limited in carrying capacity to 2.5 amperes. Keyless brass-shell sockets are rated at six amperes maximum. Key sockets are frequently used for turning on and off the current to electric irons, but this is bad practice, and often results in breaking down the socket, with liability of short-circuit.

The layman is told that an electric iron can be attached to his kitchen fixture, because the sale of the device might be more difficult if he were told that a special outlet should be provided for plugging in the iron. The ordinary fixture is wired with No. 18 or No. 16 B. & S. gauge rubber-covered wire, which have capacities of three amperes and six amperes respectively. No. 16 is large enough for an iron but No. 18 is not. A feed-through switch installed on the cord near the iron or other device will take the wear caused by opening the circuit at the socket.

Most fires caused by electric irons have resulted from leaving the current on with the iron resting on the ironing board. The fact that current is "on" is not apparent, and therefore, in many localities pilot lamps (2 candlepower or 4 candlepower) are used as shown in the figure. When current is flowing in the iron the lamp is lighted. This lamp, therefore, indicates at all times whether or not the iron is being heated or whether it is dead. Special flush receptacles with indicating lamp mounted inside are on the market for use in residences and where the arrangement as shown in the figure would not be desirable because of its appearance.

In adding electric heating devices, lighting circuits are very often overloaded. Fuses are blown and larger ones of little protective value substituted. The following table gives the rating of some popular heating devices, their amperages and their equivalents in 16-candlepower one-half-ampere carbon lamps. The branch lighting circuit should not exceed 660 to 700 watts—12 to 13 ordinary 16-candlepower carbon-filament lamps:

	Watts required.	Approximate Amps. 110-120 V. circuit.	Equivalent No. 16 candle-power, 55 watt lamps.
Flat iron—3 lb...	360	3.3	7
Flat iron—5 lb...	390	3.5	7
Flat iron—6 lb...	500	4.5	9
Flat iron—7 lb...	550	5.0	10
Tailor's-Goose Iron—12 lb.....	660	6.0	12
Tailor's-Goose Iron—15 lb.....	715	6.5	13
Tailor's-Goose Iron—20 lb.....	825	7.5	15
Toaster	400 to 800	4 to 7	8 to 14
Disc Stove.....	500	4.5	9
Coffee Urn	150 to 440	1.5 to 4	3 to 8
Chafing Dish....	250 to 50	2.5 to 5	5 to 10
Radiator, Invector type, single heat.....	880	8.0	16
Radiator, Invector type, two or three heat	1320	12.0	24
Radiator, Radiant type, ...	500 to 2,500	4.5 to 20	9 to 40
Curling Iron heater.	220	2.0	4
Shaving Mug....	220	2.0	
Portable Instantaneous Water Heater	990	9.0	4 18
Heating Pad.....	50	.5	1
Cigar Lighter....	75	.75	1.5

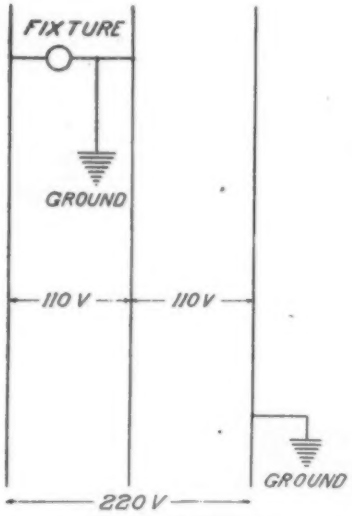
Small motors such as are used on 8, 12, 16-inch fans, small portable vacuum cleaners, for operating copying and adding machines, jewellers' buffers, etc., can be safely connected to fixture key sockets providing the motors are not over one-eighth horsepower.

The Ft. Worth (Tex.) City Council recently passed an ordinance providing that all new wiring within the city's fire limits must be in conduit.

AN UNUSUAL CASE OF ACCIDENTAL GROUNDING.

By William J. Murphy.

One evening recently in a certain store in this city a circuit of about a dozen tungsten lamps suddenly burst into very unusual brilliancy; but after a few seconds this was changed to deep gloom. The merchant, not being versed in things electrical, replaced some of the lamps, which likewise, after a brilliant existence of a few seconds, again gave place to darkness. There were a further few repetitions of this performance, and the conclusion was arrived at that it was a case for an electrician. Someone volunteered the information that the voltage had jumped up suddenly and that the electric light company was to blame for the burnt-out lamps. At this point I was called upon to investigate the trouble. As there were no other complaints of burnt-



Location of Grounds.

out lamps in the immediate district, I at once dismissed the idea of any rise in the line voltage and began to look for a neutral fuse blown. Investigation showed that everything was in order in this respect and that all the circuits in the building were at the normal 110 volts, except this one circuit, which showed a pressure of 220 volts. The service was three-wire the distribution here being 110-220 volts, with three-wire single-phase secondaries, and the neutral grounded. One outer wire of the service was disconnected entirely, and then tests were made to prove that only 110 volts entered the building; but on again testing the faulty circuit it was rather startling to find that it still showed 220 volts. The wiring was a concealed knob and tube system which had been in service without giving any trouble for several years. Inspection of the wiring did not reveal any unusual conditions; but eventually tests showed a ground on one of the fixtures. When this was removed the circuit was then at normal 110 volts. Further investigation brought to light the fact that the ground wire had been accidentally removed from the secondary neutral and that there was a heavy ground on one outer wire, which by means of testing and elimination, was discovered in the metal panel box of another building about a block away. The wiring insulation of the fixture had broken down at the point where it joined the neutral and had made a 220-volt connection through the fixture, metal ceiling, steam pipes and earth to the other grounded outer. The condition of the circuit is indicated in the accompanying figure.

A New Method of Joining Electrical Conductors.

A new method of making joints and conductors has been devised by Carl Egner and Seth Ljungquist of Stockholm, and described in *Elektrotechnische Zeitschrift*. The object of the method is to obtain good points in as simple a manner as possible.

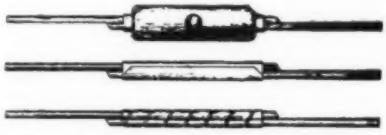


Fig. 1.—Outdoor Joint, Prepared, Fired and Complete.

For outdoor work the wires to be connected are carefully cleaned and covered with flux. The two ends are inserted in a soldering tube so that they lie side by side. The inner portion of the tube consists of tinned sheet copper rolled spirally into a tube with an elliptical cross-section which just fits the wires. Surrounding the copper tube a thin sheet of solder is wound and the whole is surrounded with a protecting sheet of aluminum. An inflammable material is placed on this tube, consisting of the same material which is used for storm-proof matches and is supplied with an ignition cap. It is fired by rubbing against a specially prepared paper, such as is used with safety matches. The inflammable material burns rapidly upon ignition and the heat produced melts the solder, which fills the space between the tube and the wires. As soon as the joint is cold the aluminum is removed. Since aluminum does not take solder, it remains loose. Fig. 1 shows three steps in the process.

The protecting sheet of aluminum is important for several reasons. In the first place it prevents the fumes of combustion from coming in contact with the solder; secondly, it distributes the heat more evenly; and finally, it prevents the solder from running out. The tube must, of course, be held horizontal during the operation.

After the inflammable material is ignited it cannot be put out by either wind or rain. In order to get the best results, however, it is well to shield the joint from the wind during the operation.

Joints made in this way have been subjected to a number of tests which have shown that the strength of the joint was even greater than that made by the ordinary methods.

For indoor work with soft copper wire a somewhat different tube is used,

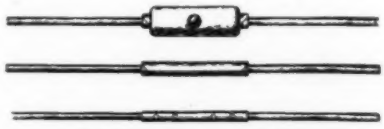


Fig. 2.—Indoor Joint.

the copper forming a simple tube with an opening lengthwise and supplied with a number of holes through which the solder may penetrate. In this case the wires make a butt joint end to end in the tube instead of being placed side by side. Otherwise the proceeding is the same as described above. Fig. 2 shows such a joint. Of course this form of joint can be made by the use of any other source of heat in place of the inflammable material mentioned. In that case only the copper tube, solder and aluminum shield are required, and the gasoline torch or spirit lamp may be applied to melt the solder.

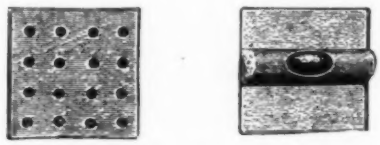


Fig. 3.—Solder Plates for Cable.

In cases where cable is to be spliced, a special arrangement is used. Solder-plates both with and without inflammable material are supplied. This solder plate consists of a sheet of solder containing a number of holes, which is fastened to the protecting aluminum by means of a solution of rosin which serves both as a binding material and as a flux. Fig. 3 shows the two kinds of solder plates for indoor and outdoor work. The strands of the cable are spliced and then the solder-plate is wrapped around it and heat applied.

In attempting to move an electric wire that had fallen to the ground, an employee of the Public Service Corporation of New Jersey was recently killed. He is said to have depended upon his overcoat pocket, used as a glove, to protect him from danger in handling the wire.

Dinner to the Brooklyn Electrical Contractors.

The annual dinner to the electrical contractors of Brooklyn, N. Y., given by the Edison Electric Illuminating Company of that city, was held at the Union League Club, Bedford Avenue, Saturday evening, February 24. Over 200 were present, and T. I. Jones, general sales manager of the Edison Company, was the versatile and capable toastmaster. The dining room was handsomely decorated with flowers and electric lights, and a souvenir in the form of a paperweight containing a photograph of Thomas A. Edison was left at each plate.

At the conclusion of the repast, addresses were delivered on the subjects named, by the following gentlemen:

"The Contractor," by George Weiderman, president of the George Weiderman Electric Company.

"The Public Service Commission," by Milo R. Maltbie, public service commissioner for the First District, State of New York.

"The Borough of Brooklyn," by Louis H. Pounds, commissioner of public works, Borough of Brooklyn.

"The Edison Company," by W. W. Freeman, vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn.

Each speaker had something to say, and said it well, and was greeted with much favor. Mr. Freeman proved to be particularly popular, and received an ovation when he rose and also at the conclusion of his address. The occasion was probably the most enthusiastic and promising as to results that has yet been held, and the dinner a particularly good one. The Committee of Arrangements consisted of J. L. Wiltse, chairman; Irving Bugg, I. D. Phillips, J. E. Weis Mandel, H. G. Disque and J. H. Porter.

Those at the head table were: P. R. Atkinson, Theodore Beran, J. P. Bonney, H. P. Erwin, J. C. Forsythe, W. W. Freeman, T. I. Jones, M. R. Maltbie, T. E. Murray, L. H. Pounds, Charles W. Price, F. W. Smith, George Weiderman, W. F. Wells.

Among others present were: A. A. Attix, A. D. Babson, J. F. Becker, I. Bugg, J. D. Campbell, K. C. Chamberlain, Z. A. Cooper, W. J. Donnelly, W. T. Fairbairn, C. P. Hill, Dr. H. Jewett, G. L. Knight, E. A. Leslie, J. G. McCarthy, E. H. Nostrand, W. H. Onken, Jr., I. D. Phillips, B. F. Rush, M. S. Seelman, H. A. Sinclair, S. D. Sprong, H. Tatem, C. H. Thurling, C. J. Woodward, Jr., E. W. Babcock.

Laboratories To Be Enlarged.

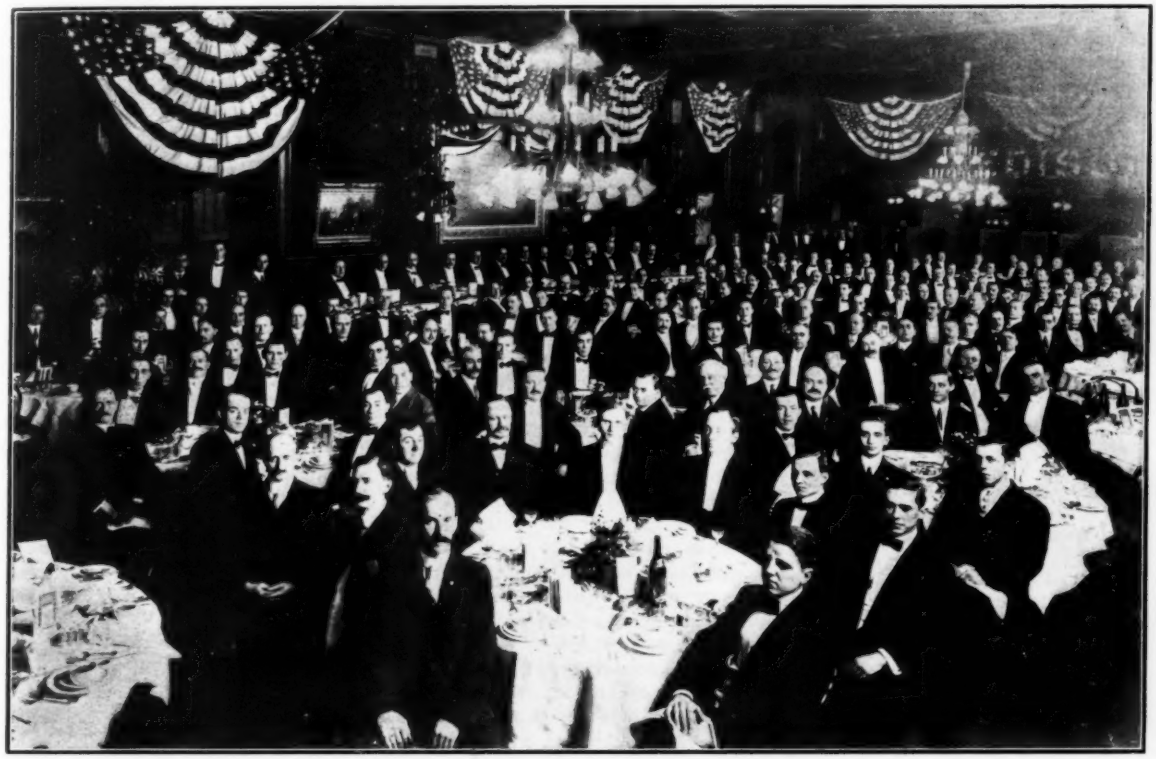
It is stated that further enlargements of the Underwriters' Laboratories are contemplated. This announcement was made in connection with the recent celebration of the tenth anniversary of the Laboratories.

Testimonial to William McDevitt.

William McDevitt, who was succeeded on the first of the year by Washington Devereux as inspector of the electrical department of the Philadelphia Fire Underwriters' Association, after a continuous service of twenty-three years, was the recipient of a costly and beautiful testimonial, on February 13, at a dinner tendered him at the Bellevue-Stratford by personal friends in appreciation of the value of his long years of service in Philadelphia in the study of the causes and prevention of fires.

Mr. McDevitt holds the unique position in the fire protective community as the pioneer of the United States in the technical and mechanical study of the sources of danger from electric wiring, and many useful and timely suggestions emanating from him have been embodied in municipal ordinances, regulating the wiring of buildings. He has devoted a lifetime to the subject and is one of the foremost authorities in the country on practical subjects relating to the origin of fires. He was appointed chief inspector of the Fire Insurance Patrol of Philadelphia in 1873, and in 1889 he was chosen for the position of electrical inspector of the organization now known as the Philadelphia Fire Underwriters' Association.

The gift presented to Mr. McDevitt at the Bellevue-Stratford dinner was a



Dinner to Electrical Contractors of Brooklyn.

very fine gold watch, with an expensive Swiss movement, and a testimonial inscription engraved on the case. The diners who took part in the tribute to Mr. McDevitt, representing the community of electrical experts in Philadelphia, were Joseph B. McCall, Walter H. Johnson, J. T. Maxwell, C. L. Eglin, A. J. DeCamp, Albert H. Manwaring, Isaac C. Walker, H. G. Kepler, William Drysdale, Walter C. McIntire, Elmer Strang, Washington Devereux, J. Crawford Bartlett, Benjamin L. Oates, Edgar J. Ellis, John J. Gibson, George H. Hoffman, E. D. Mullen, Charles J. Russell Gilbert S. Smith and Mr. Murphy. President McCall, of the Philadelphia Electric Company, presided and made the presentation of the gift to Mr. McDevitt. Since his retirement as the active head of the electrical department, Mr. McDevitt still remains as Chief Inspector of the Philadelphia Fire Underwriters' Association.

Thawing Water Pipes in New York.

The Power Bureau of the New York Edison Company has recently been kept quite busy attending to frozen water mains, over 400 cases being handled in one week. In most instances the pipe was under one inch in size and the average time required was 30 minutes. Two methods are in use. Where there are no mains in the building a storage battery is employed. When current is available in the building this service is utilized, a water rheostat being employed in the connections in order to control the current. Five trucks have been detailed for this work, of which one carries a storage battery and the others a water rheostat.

A Proposed Wiring Rule.

In a letter published in two of the London electrical journals a writer urges that when electric circuits are represented in drawings and diagrams, opposite wires of the same circuit should be indicated by lines of different thicknesses or of different colors. He argues, too, that there would be a great gain in convenience if in actual circuits wire having an insulation of one color were employed always for a given side of the circuit while another color of wire was employed for the opposite side.

Electric Heating for Zoo Animals.

The recent excessively cold weather made it necessary to heat the bear caves in the Zoological Garden in Bronx Park, New York City. As it would be inconvenient to pipe steam to this point from the power house, it was decided to use electric heating, and consequently electric radiators were installed in each den, properly protected against the embraces of Bruin.

WIRING IN METAL REFINERIES.

By H. G. Wilson.

Owing to the extreme heat in crucible and furnace departments and the presence of acid fumes in the copper-sulphate houses, the proper wiring for electric light and power in metal refineries is sometimes an undertaking of considerable proportions. While, as a rule, the motors employed in plants of this kind can be placed out of reach of the detrimental effects mentioned, the use of squirrel-cage induction motors is to be preferred, since these have no sliding contacts. When these are used it is best to paint the insulation of wires exposed to acid fumes with hot tar. If the service is such that direct-current motors must be employed, these should by all means be of the completely inclosed type, in order to make them immune from the effects of dust, which is always undesirably prevalent here.

Overhead wiring in furnace buildings should preferably be done with asbestos-covered conductors on cleats or split knobs which hold them one inch from the surface wired over and six inches apart. Screws should be used rather than nails and leatherheads in securing the knobs or the cleats in position, for in a room where the temperature is from 125 to 150 degrees, as is the case here, leatherheads soon become practically worthless.

When wiring is to be installed in metal refineries already completed, as much of the work as possible should be done outside the rooms, since on the inside the acid fumes and heat may be very trying to workmen. This outside work may be made to include such jobs as loosely screwing the insulators to the supporting blocks, cutting conductors to the proper length, making splices and taps for drop lights, and so on. When this has been done, comparatively quick work may be made of putting the supporting blocks in place and completing the installation of the various circuits.

It may be worth while to mention here, also, that in construction of the kind in question only the best workmanship and material should be employed; for, since the making of repairs on the wiring is apt to be a very trying undertaking, the highest possible degree of permanency is desirable, of course. Moreover, contractors in submitting bids on jobs of this kind, should always make a generous allowance for labor, as only about half the work can be accomplished as it would be under better conditions. This last precaution only applies, however, where the wiring must be done after the plant is running.

All wiring for switch legs and on sidewalls should be placed in rigid conduit as a protection from mechanical injury. Porcelain sockets seem to withstand the conditions better than others. Single-wire cleats or split knobs should be used in place of rosettes, with each wire anchored separately. Steel cut-out cabinets are preferable, as wooden asbestos-lined boxes soon dry out and become defective unless they are thoroughly seasoned. All openings around wires should be filled to prevent the entrance of dust, which will, in time, result in poor contacts, and for this same reason snap switches are preferred to knife switches. No. 14 rubber-covered stranded wire for drop cords is used to good advantage in this service.

A permanent method for wiring the copper sulphate houses is still being sought, as the sulphuric acid fumes rot the braiding on the wire and also have a dehydrating effect on the rubber, which soon dries it out and renders it useless as an insulator. A rather damp atmosphere has also to be considered, caused by the escaping steam from the vats, which may even render other insulations than rubber unreliable. Conduit work and also lead-covered twin wiring on insulators have been used with more or less good results. However, the conduit does not protect the insulation from the acid fumes and the difficulty of making a good joint in the lead-covered cable has proved its weak point.

A certain metal refinery which had been annoyed with breakdowns in the electric wiring due to the causes indicated, finally resolved to try the construction described in the following. The first cost proved to be high, but several years' use of the system has shown that the investment was a wise one.

Sound hardwood molding was thoroughly warmed and generously painted on all surfaces with hot tar, so that the pores were filled as much as possible. The rubber-covered wire to be used was next coated with tar, care being taken to leave no uncovered spots. The wires then were placed in the grooves in the molding and the space that remained unfilled was also tarred with as much tar as could be made to stick. The capping was then put in place after getting a coat of tar on all surfaces. Attention was also paid to the surface on which the molding was placed by selecting a time when it was comparatively dry and painting a strip with tar a little wider than the molding.

Porcelain molding receptacles were used wherever practicable and for drop lights No. 4 rubber-covered stranded wire was employed.

National Electrical Inspectors' Association

THOMAS HENRY DAY, President, 59 Deerfield St., Hartford, Conn.
JAMES BENNETT, Vice-President, 524 Coristine Bldg., Montreal, Que.
WILLIAM LINCOLN SMITH, Sec'y and Treas., Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham St., Boston, Mass.

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Concerning Size of the Neutral.

Question 166. Is it permissible to reduce the size of the neutral on say an Edison substation as follows? The panelboard carries a balanced three-wire distribution for lighting and 220-volt two-wire power work. Service switch, master meter and individual meters on the several branch distribution mains are provided.

a. May the neutral from the service switch to the master meter and panel board be smaller than the outside wires?

b. After leaving this substation with a three-wire distribution branch main, may its neutral be run smaller than the outside wires?

Answer 1. According to Rules 23-*a* and *b*, the neutral may be smaller than the outside wires if properly fused.

Answer 2. It is not prohibited by any rule in the Code to install the neutral of a three-wire system smaller than the outside wires; provided, of course, the fuse is of proper size to protect the wire. However, if the neutral is smaller than the outside wires, Rule 23-*a* prohibits the omission of the main fuse even though the system be grounded in accordance with the Code.

Answer 3. *a*, Yes. *b*, Yes—provided, the smaller wire is properly protected by a fuse not greater than its carrying capacity. See Rule 23-*a*. The writer does not, however, consider it good practice to reduce the size of the neutral wire.

Answer 4. *a*, Yes; but the neutral must be large enough to carry current which would blow the fuse on an outer lighting branch. *b*, No; because the fuses on the outside wires may be so heavy as to require the full current capacity of the outer wires.

Answer 5. I believe the following to be the general practice in regard to Edison three-wire distribution systems: On all street **feeders** the neutral may be half the size of either outside wire. On all street **mains** the three wires must be of the same size.

Answer 6. It is common practice in connection with station and substation equipments to have the neutral of three-wire distribution feeders and mains of smaller capacity than the outside conductors, and such practice is permissible in this territory. This also covers a service or services entering a substation and three-wire distribution mains leaving substations, either underground or overhead, to the various subscribers.

Answer 7. The neutral may be made smaller than the outside wires, provided that it is properly fused, and that one has reasonable assurance that the two sides will remain fairly in balance. I should answer Yes to *a;* and to *b*, Yes, if it be properly fused, but it is very poor practice, as there is more chance for unbalancing, and if you lose your neutral fuse you lose your protecting ground.

Secretary's Announcement.

The Secretary wishes to explain that illness has prevented his submitting his usual monthly message this month. He wishes also to announce that since the last issue of this section, John M. Glenn, of the New England Bureau of United Inspection, 71 Kilby Street, Boston, has been elected a member of the Association.

Fuses for Motor Circuits.

Question 167. Would it be in accordance with the rules to take a 220-volt motor circuit off of a three-wire 110-200-volt feeder that is fused with a three-wire Edison plug cutout, the motor being properly protected with a cartridge fuse cutout; or should the three-wire plug-fuse cutout be changed to a three-wire cartridge-fuse cutout? It is understood that in either case the wires are properly protected as regards the size of fuses.

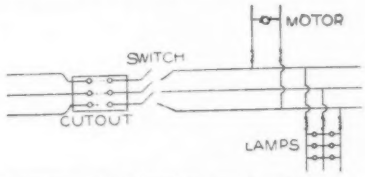


Diagram of Circuits in Question 167.

Answer 1. The installation of the Edison plug cutout would meet requirements if the neutral was grounded.

Answer 2. In the installation described, the 220-volt motor circuit cannot be considered as anything but a 220-volt circuit and therefore all fuses should be constructed for this voltage, including the main fuses in the outside wires, which fuses are unquestionably in the motor circuit. It is obvious that in case of severe trouble with the motor, if either main fuse should be called upon to operate, it would have to break a circuit of 220 volts pressure.

Answer 3. Yes, it is in accordance with the rules, but the writer would require 220-volt fuse protection in the main cutout as well as in the motor branch.

Answer 4. Yes, it would be proper to use a three-wire Edison plug cutout, provided the capacity of the motor did not exceed 30 amperes.

Answer 5. Assuming that fuses are of correct size, I see no reason why the three-wire plug cutout should be changed to a three-wire cartridge cutout.

Answer 6. Provided a 220-volt motor was properly protected by standard cartridge inclosed fuses, we would permit the connecting of these cutouts to and the feeding of same from a three-wire main protected by an approved three-wire plug cutout.

Answer 7. Under the assumption that the fuses properly protect the wires, I can see no reason for changing the plug cutout to a cartridge type.

Grounding Through Armor of Cable.

Question 168. In a large conduit system with heavy mains, would it be good practice to make the ground connection through the armor of a No. 14 (BX) cable? Would it even be permissible?

Answer 1. If the carrying capacity of the armor of the cable is equivalent to that of the size of ground wire required, taking into account the relative conductivity of the two metals, then such an installation would be permissible; but as for its being good practice, I think that would depend upon circumstances.

Answer 2. Rule 27-*c* does not require the ground connection to be made at any particular point of the armored cable system, but it does specify that the ground wire be No. 10 B. & S. gauge or larger. It is very doubtful if the armor of No. 14 cable would have a safe carrying capacity as great as the proper size of ground wire for a large system. Also Rule 27-*c* requires the armor to be "permanently and effectually" grounded, and if there is any doubt of the ability of the armor of a branch cable being able to successfully carry any current which it might be called upon to carry (if, for instance, a breakdown should occur on the service wires), then the system could certainly not be considered "effectually" grounded.

Answer 3. No, it would not be good practice, and the writer would not permit it, but would insist that ground connection be made on the largest size conduit.

Answer 4. No, it would not be good practice, not even allowable. See Rule 28-*f*, 1911 Code.

Answer 5. It is not allowable to ground the secondary to the armor of a No. 14 BX cable. (See Rule 15-*d*, *f* and *g*). For grounding the conduit system, however, there would be no objection to using the armor of the cable in cases where its capacity is equivalent to that of the ground wire which would otherwise be required.

Answer 6. In large conduit systems with heavy mains it would not be good practice to make the ground connection through the armor of a No. 14 BX cable, and same would not be permissible here.

Answer 7. I should not allow it as I do not believe one could be sure of its equivalent carrying capacity without extensive testing, and on alternating-current work I should feel suspicious as to the effect of the spiral flow of current in a magnetic material; for on the ground connection you do not have equal and opposite effects found where the two wires of opposite polarity are encased in one conduit.

Code Requirements and Motor Starters.

Question 169. What rule in the Code requires a rheostat to be used in connection with a direct-current motor, or an auto-starter with an alternating-current motor? If none, how can an inspector require one to be used?

Answer 1. There is no rule which requires the installation of either a rheostat or an auto-starter, consequently the inspector cannot insist upon their being installed, but where he considered it necessary to have them he ought to be able to convince the owner that such was the case.

Answer 2. There is no rule in the Code to require a starting rheostat or an auto-starter on a motor installation. However, under Rule 8-*b* the motor leads must be large enough to carry the starting curent without over-fusing, and under Rule 8-*f* the inspector might require a fireproof inclosure, if he can show that the use of the motor without a starter involves any serious danger of a burnout of the motor.

Answer 3. The code does not specifically state that a rheostat or auto-starter shall be used on direct-current and alternating-current motors respectively, as certain size motors do not require their use. Yet the Code infers that the said devices must be used in connection with motors of certain sizes, as it specifies how rheostats and auto-starters shall be installed. An inspector can require their use when the motor is of such size as to constitute a fire hazard without some such protective device.

Answer 4. Rheostats or auto-starters are absolutely essential in most cases, and therefore it is not necessary for the Code to specify the use of them.

Answer 5. While there is apparently no definite rule in the Code requiring a rheostat for a direct-current motor or an auto-starter for an alternating-current motor, there are two ways in which the inspector can enforce the requirement. One is by requiring heavy enough copper to conform to the fuse which must be used to take care of the inrush current if the starting device be not used. The other is to point to the fact that the absence of a starting device throws an abnormal strain upon the equipment and in this way renders it unsafe.

Answer 6. There is no rule requiring the use of a rheostat or auto-starter in connection with motors, the existing rules covering construction and installation of such devices only. The necessity for installation of such devices is governed by the type, and capacity.

Answer 7. No rule requires it. It is a matter of engineering practice. If the machine can be started under any ordinary condition of load without taking out the fuses which properly protect the leads, that is all, under the rules that can be demanded. But there are more ways of killing a cat than drowning it in cream and the inspector ought to be able to get a rheostat installed if he thinks it necessary.

Among the Supply Men

Annual Convention of the Electrical Department Managers and Salesmen of the H. W. Johns-Manville Company.

On February 5, there assembled in the new Manville Building, Madison Avenue and Forty-first Street, New York, over one hundred men who had arrived from all parts of the United States and Canada to attend the annual convention which the H. W. Johns-Manville Company holds for its Electrical Department managers and salesmen.

J. W. Perry, general electrical manager, called the convention to order and briefly outlined the purposes of the meeting. The first subject was "Modern Illumination," by W. H. Spencer, illuminating engineer of I. P. Frink Company, the sole selling agency of which has recently been acquired by the H. W. Johns-Manville Company. "J-M Linolite" was thoroughly taken up by W. S. Kilmer, the company's illuminating engineer. Actual service demonstrations were given in the evening of bank and desk reflectors, direct and indirect lighting fixtures and some new types of Frink electroliers and lighting novelties.

Tuesday was devoted to a discussion of J-M Linolite lamps by Dr. J. F. Meyer; Westinghouse lamps, by Norman Macbeth and T. F. Fisher; all three of these men being connected with the Westinghouse Lamp Company. J-M Transite asbestos wood was discussed by S. A. Williams, W. D. Ligon, S. P. Russell and F. C. Reilly; J-M fibre conduit by W. D. Ligon and W. R. Seigle; "Overhead Line Material" by C. W. Schultz and W. D. Ligon; "Electrobestos Insulation and Dielectric Cements," by J. R. McLain.

Wednesday was given up to "Friction Tapes and Splicing Compound," by J. W. Perry and H. M. Frantz. "J-M Electrotherms and Special Heating Devices," by J. R. McLain. "J-M Air-Brake Cylinder-Packing Expander Rings," by George Christensen. "J-M Dry Batteries," by E. Whitmore. "Lightning Arresters, Trolley Catchers and Retrievers," by W. R. Garton. "Asbestos Products for Electrical Power Plants," by L. R. Hoff.

Two special Pullman cars conveyed the convention representatives, on Wednesday evening, to Hartford, Conn., where the factory of the Johns-Pratt Company is located, and for which company the H. W. Johns-Manville Company is sole selling agent. Thursday morning the men assembled in the convention hall at the factory of the Johns-Pratt Company. J. W. Perry opened the meeting and President E. B. Hatch, of the Johns-Pratt Company, delivered an address of welcome. R. C. Cole, electrical engineer, occupied the entire morning with a discussion of "Noark" enclosed fuses, and in the afternoon the subject of "Noark" service, fuse and subway boxes was handled by D. C. Hooker, assistant electrical engineer. The evening was spent in the testing laboratories of the factory, where many interesting tests of high-tension fuses and boxes were made.

Friday was entirely given up to the discussion of insulating materials and

overhead line material. The subjects were handled by A. G. Newton and R. B. Lattin, of the Johns-Pratt Company, and C. W. Schultz, of the H. W. Johns-Manville Company.

On Saturday the representatives devoted the morning to inspection of the factory, and in the afternoon an inspection of one of the substations of the Hartford Electric Light Company, where is installed a large quantity of "Noark" high-voltage service boxes and fuses. R. C. Buell, secretary of the Johns-Pratt Company, delivered an appropriate address at the conclusion of the meeting.

On Saturday evening a banquet was given to the representatives by the Johns-Pratt Company, at the Hartford Club, and in addition to those who attended the meetings all week, T. F. Manville, president of the H. W. Johns-Manville Company; J. E. Meek, manager of the Railroad Department; H. R. Trainer, manager of the Boston branch, and George F. Spencer, president of the I. P. Frink Company, were in attendance. The closing of the banquet concluded a very interesting and profitable convention, and throughout the entire proceedings the spirit of good fellowship and co-operation predominated, and all present declared it was the most profitable and enjoyable affair it had ever been their good fortune to attend.

Supply Men and Their Interests.

For some time it has been the custom of the Western Electric Company to hold a sales conference at the time of the meeting of the Electrical Supply Jobbers' Association. In accordance with this custom a meeting was held at Cleveland at the Hollenden Hotel on Friday, February 16. There was a very interesting discussion of various matters relating to conditions of trade in every part of the country. Among those present were: E. M. Rockefellow, H. L. Grant, R. M. Hatfield, G. E. Cullinan, W. Hoagland, H. W. Hall, H. C. Owen, J. S. Rogers, E. H. Peterson and C. B. Baldwin.

E. W. McClelland, formerly manager of the supply department of one of the electrical supply houses in the northwest, is now with the Metropolitan Electrical Supply Company, Chicago, having accepted the position as secretary with that company.

W. L. Hawley, for the last four years with the Post-Glover Company, Cincinnati, O., and formerly with the Crouse-Hinds Company, Syracuse, N. Y., has accepted the position of sales engineer with the J. Lang Electric Company, Chicago, Ill.

The Electric Supply Company, of Saginaw, Mich., has been organized in Saginaw to do an exclusive wholesale jobbing business, and will open up about April 1. R. H. Kimble, formerly of the Central Electric Company, of Chicago, Ill., will be manager.

Public Service Commissions

NEW YORK.

The Public Service Commission, Second District, has authorized the issuance of $200,000 in bonds by the Suffolk Gas and Electric Light Company; $300,000 in promissory notes by the Auburn and Syracuse Electric Railroad Company; $12,000 in stock by the Riverhead Electric Railroad Company.

Authority has been granted to the Adironack Electric Power Corporation, which has taken over various electric companies generating power on the Upper Hudson River, to issue its common capital stock to the amount of $9,500,000; preferred stock to the amount of $2,500,000, and 50-year, five-per-cent gold bonds to the amount of $5,000,000. This is the first reorganization case decided by the Commission since the decision of the Court of Appeals in the Third Avenue Railway case, which interpreted the law limiting the supervision of the Commission over reorganizations. Up to the rendering of this decision, the Commission says in an opinion accompanying its order, it "has uniformly held in reorganization cases that a reorganized corporation should come to us upon precisely the same footing as any other corporation in the matter of an issue of stock and bonds. It has acted upon this prinicple in various cases with excellent results, uniformly holding that an issue of stocks and bonds must bear a proper relation to the value of property for which they were issued. This view of the law was overturned by the Court of Appeals in the Third Avenue case, and we see no escape from the conclusion that this determination of the Court of Appeals is binding upon this Commission so far as the amount of the securities to be issued is concerned."

The Commission further states under the law as it now stands it has no power except in two particulars, viz: whether the applicant is, in fact, a corporation duly incorporated pursuant to the laws of the state under the Stock Corporation Law, and entitled to all the rights flowing from such incorporation, and to determine that the securities of the reorganized company are not in excess of the valid outstanding securities of its predecessor.

The later provision allows the reorganization of an insolvent corporation to water the stock and bonds up to the amount that the stock and bonds of the former corporations were watered, but no more.

The new corporation is a reorganization of the Hudson River Water Power Company, Hudson River Power Transmission Company, Saratoga Gas, Electric Light and Power Company, Hudson River Electric Company, Hudson River Electric Power Company, Madison County Gas and Electric Company and Empire State Power Company.

WISCONSIN.

Recognizing the fact that certain types of meters, particularly meters of the induction type, are more stable than others, and that possibly some distinction might properly be made between meters of varying types, sizes and earning capacities in the matter of the frequency with which the required periodic tests should be made, the Commission has granted permission to the Superior Water, Light and Power Company to amend the rule relating to standards of service. This rule provides that "each electric service meter shall be tested at least once a year." The order, which provides for a schedule that will vary the frequency of testing meters according to the income from each meter, is as follows:

Approved late type of induction meters with annual revenue of $60 or less, at least once every 18 months.

All types lighting meters with annual revenue of $60 to $180, at least every 12 months.

All types lighting meters with annual revenue of $180 to $360, at least every 6 months.

All types lighting meters with annual revenue of $360 or over, at least once every 3 months.

Induction-type power meters, once every 6 months.

Commutator-type power meters, once every 3 months.

Wherever a meter is found to register outside the requirements established by the Commission when tested on the above schedule, it shall be shifted to the next class and tested more frequently, except where the cause of incorrect registration is unquestionably due to some special disturbing influence which is not likely to occur again.

The Commission is allowing the above scheme to be tested out and reserves the right to recall the order whenever it may appear that the scheme is unsatisfactory or unreasonable.

The Commission has completed an informal investigation of the rates now charged by the Richland Center Municipal Light and Water Plant. The plant has in effect at the present time the following rates: Incandescent meter rate of 10 cents per kilowatt-hour, with a meter rental of 25 cents per month; incandescent flat rate of 60 cents a month per 16-candlepower lamp for business and 30 cents for residence consumers; a flat rate of $65 per arc per year for all arc lamps, whether burned all night or until midnight. A detailed analysis of the income accounts for the year ending June 30, 1911, showed that the total operating revenues had increased 23 per cent during the year; that the total operating expenses, exclusive of taxes, depreciation and interest, had increased 65 per cent; that the utility at present is unable to meet its ordinary expenses of operation even excluding taxes, depreciation and interest. By including an allowance for taxes and depreciation, and interest at six per cent on the cost of the plant new, properly apportioned between the two departments, the Commission found the total yearly cost of service for the electric department to be $16,754, as against $12,409 reported by the plant. The reported net earnings for the year were $9,638. Of the total expenses, $5,344 was chargeable to street lighting and $11,410 to incandescent lighting. The latter was further divided into $5,541 capacity cost and $5,869 output cost. The total energy consumed by the lighting, as determined by the consumer records, was 71,670 kilowatt-hours, which gave a unit output cost of 7.21 cents per kilowatt-hour sold. With an active load of 150 kilowatts the fixed cost of the active connected load was found to be about $36.93 a year, or $10.11 per day. Upon these bases the united costs were found to be as follows: 17.32 cents per kilowatt-hour for one hour's daily use of the active connected load; 12.26 cents for two hours' daily use; 10.58 cents for three hours' daily use; 9.23 cents for five hours' daily use, etc. Two rate schedules were suggested, either of which will return sufficient revenue to meet all expenses as shown by tables compiled in the decision. The first schedule suggests a primary rate of 15 cents net per kilowatt-hour for current used equivalent to or less than the first thirty hours' use per month of the active connected load; a secondary rate of 12 cents net for the next sixty hours' use; an excess rate of 7 cents. The alternate schedule provides for a primary rate of 12 cents net for the first sixty hours' use of the active connected load, with an excess rate of 7 cents. The classification of consumers according to the percentages of active connected load is the same as given in the Marshfield decision of two weeks ago. The rate for street lighting suggested is a charge of $80 per moffth per arc for the lamps operating from dusk to dawn, and $60 per month per lamp for those operating from dusk to midnight. All meter rentals were abolished and the minimum bill fixed at 75 cents per month.

A hearing on the complaint of the village of West Salem against the service rendered by the Neshonoc Light and Power Company has been held. The complainants petitioned for a certificate of convenience and necessity for the establishment of a second electric utility or, as an alternative, an order for the improvement of the present service. One of the grounds for complaint was the lack of a day power service, but no very great demand for such a service was evidenced at the hearing. The lighting service is inadequate, according to the testimony, and to the investigations and tests made by the Commission's engineers. At the time of the first complaint it was found to be impossible to maintain standard voltage at the time of peak load, at which time the voltage often fell to less than 85 per cent of normal. At the suggestion of the engineering department this defect was partially remedied, but, either through incompetent station operation or a lack of sufficient water power, the voltage regulation has since seldom been within the limits prescribed by law. The defendant testified that the construction of a second dam immediately below the power plant had backed the water up to such an extent as to interfere seriously with the plant operation at times of heavy load. It appeared from the testimony that little effort had been expended in maintaining the system in good working order, a condition of affairs which apparently was due, in a large measure, to the attitude of the village board, especially with reference to the many unreasonable requests which they have made. The village has demanded adequate service, but has been unwilling to pay for it. The case has been taken under advisement.

OKLAHOMA.

In connection with the telephone and telegraph preference-service order issued by the Oklahoma Corporation Commission, which put telephone calls or telegrams desired to be sent by certain state and county officials ahead of other business, an agreement was reached between the Commission and the companies affected. Representatives of the Western Union Telegraph Company and the Pioneer Telephone Company stated that they had no objections to complying with the order when they knew that the person applying for the service was entitled to it. The special privilege, it was explained by the Commission, would in most cases come from sheriffs in pursuit of criminals. It was agreed that death messages should take preference over all, with sickness next and the sheriffs or other officers next, if after criminals, and that in many cases the nature of the service would necessarily guide in the handling of the business. It was agreed further that newspaper matter, when it must be rushed to reach the office in time for publication, should have a preference right over general commercial business.

INDIANA.

The Indiana Railroad Commission has filed its sixth annual report, which shows that a total of 2,601 miles of electric railroad are in operation in the State, with a capitalization of $17,895,000. Dividends paid last year amounted to $431,200. The par value of the funded debt was placed at $20,439,000. The total operating revenue for the year was $14,127,895.41 and the total operating expenses $8,356,976. The most noted achievements of the year were the installation of automatic block signal systems on the more important high-speed roads and others are preparing to do likewise. The overcrowding of interurban cars is a fruitful cause of complaint, but assurances are given the commission that this will be remedied as soon as possible. The report shows that the development of the interurban properties in Indiana has been very rapid and that the increasing traffic has been such as to tax the present facilities. The Commission says that great improvement has been made in dispatching of trains and other precautions taken to make traveling safer and more comfortable.

MASSACHUSETTS.

The Massachusetts Highway Commission has reported to the Senate that a further readjustment and reduction in rates of telephone service in the metropolitan district is inadvisable and inexpedient until existing rates have received a fair trial.

SANGAMO AMPERE-HOUR AND WATT-HOUR METERS.—II.

By Joseph B. Baker.

The adiustments of the direct-current meter are for light load and full load, and for drop in the shunt, which takes the bulk of the load current in meters of capacities above 10 amperes, as explained.

Light-load compensation in 220-volt and 500-volt service meters is by a thermo-couple placed behind the shunt coils of the meter and consisting of two strips of dissimilar metals joined together and surrounded by a heating winding of resistance wire in series with the shunt coils of the meter. The purpose of the thermo-couple is to pass a current through the armature of the meter in order to give a slight inital torque to overcome the initial bearing friction common to all types of motor meters. The

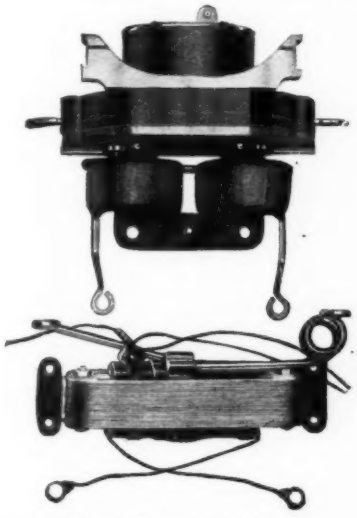


Fig. 6.—Motor Element and Laminated Yoke of Alternating-Current Meter.
Transformer Below.

adjustment is by a clamp slider, which is moved to the left or right to give more or less friction compensation, respectively. The other method of light-load compensation employed is to use part of the shunt-field current to give a slight starting torque. The means of full-load compensation is the same in both direct and alternating-current meters, and consists of a soft-steel disk, so disposed above the poles of the damping magnets that it can be adjusted to shunt more or less of the flux, thereby varying the retarding effect without shifting the position of the magnets themselves. Compensation for drop in the shunt is by a sliding series adjustment in the form of a small clamp.

In the alternating-current meter (type F) the U-magnet carries a series winding, energized by the load current: a small internal transformer is provided, with its primary connected across the mains in 110-volt, 220-volt or 440-volt meters and with a heavy one-turn secondary arranged to pass a large volume of current at low voltage through the mercury-immersed armature. By this arrangement the armature carries continuously (as long as voltage is on the mains of the consumer's installation) a current proportional to the line voltage and stated to be substantially in phase therewith; and the reaction between the armature field due to this voltage and the main field due to the load current and in phase with same gives a torque proportional to the energy consumption, just as in the direct-current meter. When the load is non-inductive, so that the current passing through the series winding is in phase with the line voltage, the meter will have maximum torque, necessary for correct registration. On inductive load the lag of the current through the series winding maintains correct phase relation with the current in the armature so as to give correct registration down to the lowest power-factors.

Fig. 7.—Auto-Type Meter.

The laminated magnet yoke carries two strap-wound series coils to facilitate connection of the meter for two-wire or three-wire operation.

In Fig. 6 the construction of the type F meter is shown. The laminated series magnet is locked in position, above, and the small potential transformer is below. The primary terminals of the transformer are shown brought out beneath same, and the terminals of the heavy secondary, adapted to be connected to the ears of the mercury-immersed electrodes, are above.

The light-load adjustment of the alternating-current meter is by means of a small auxiliary secondary winding of the potential transformer which passes a small volume of current around the poles of the series magnet. The full-load compensation is by an adjustable magnetic shunt as already described in connection with the direct-current meter.

In electrical characteristics this meter is stated to have small friction compensation owing to the mercury flotation of the rotating system. It shows a variation not to exceed 0.5 per cent for 20-per-cent change in voltage from normal at one-tenth of full load, and no error at full load on same change. Shunt losses of meters of 50 to 133 cycles are stated to be 1.5 watts at 110 volts and 2.5 watts at 220 volts. The mode of operation by the small internal transformer is stated to be especially valuable in reducing losses at low frequencies. The copper loss in series coils is that corresponding to 0.4 volt in a five-ampere meter; and as part of this loss is reactive the wattage loss in this meter on full load is 0.7 watts. The voltage drop in a 10-ampere meter is about 0.4 volts, and the wattage 1.4 watts at full load. The meter is stated to be remarkably independent of changes of frequency and of temperature, and to have about 50 millimeter-grams torque on full load in both alternating and direct-current types.

The test meter, or rotating standard, is made in both direct-current and alternating types, in a case equipped with a brass handle at the top and with three brass legs which support the meter about four inches above the table on which it is placed—the front leg being attached to the meter cover and removable with same. A disappearing lug on the back

Fig. 8.—Street-Car Watt-Hour Meter.

of the meter provides for hanging the meter on the wall where this is most convenient. A feature is the white-enamel finish of the damping disk on which is painted a circular scale of 20 divisions to facilitate observations of the number of revolutions of the disk to a fraction of a revolution by the aid of a fixed pointer projecting over the disk. Above the disk is placed a circular counting train having two dials reading respectively 10 and 50 disk revolutions.

The trip-reading watt-hour meter for checking the consumption of power on street cars is shown in Fig. 8. This meter is of the same general design as the service and switchboard meters, as far as interior construction goes, but is equipped with a device for re-setting the "trip-reading pointer" (consisting either of a special key furnished with the meter or of a push button and knurled thumb

nut, as shown in the illustration) adapted to be operated by the car inspector or conductor at the start and completion of a trip. The periodic re-setting of the large pointer in no way affects the registration of the main recording train.

The ampere-hour meters made by the Sangamo Electric Company comprise, as stated, meters for electroplating work, for electric vehicles (storage-battery automobiles) and central-station batteries.

The electroplating ampere-hour meter is designed to afford a more convenient and accurate record of the amount of metal deposited in a plating bath in a given elapsed time than may be obtained by noting the average current flow during the period by observing an indicating ammeter. This meter also does away with the necessity of computing the average current with the electrochemical equivalent of the metal being deposited, as the meter is furnished with a dial which reads in any desired unit weight of the metal with which the meter is to be used: for example, pennyweights of silver, grains of gold, or pounds of copper, according to the conventional methods of expressing the weights of the various precious and base metals in use by electroplaters.

In design, the electroplating meter is similar to the watt-hour meters already described, but the internal arrangement differs from same as shown in Fig. 9, this meter being an ampere-hour meter and not a device for recording watt-hours. In actual construction a large movable pointer operated by a knob in the middle of the glass window over the dial can be set at the point on the dial indicating the amount of metal which it is desired to deposit in any particular plating operation—thus giving a plain reference point for the workman and facilitating the discontinuance of the plating when the recording pointer reaches the determined figure on the scale. The meter pointer, on reaching the hand-set pointer, makes an electrical contact therewith and operates a visual or audible signal to the workman; or the contact may be arranged to trip a circuit-breaker to automatically interrupt the plating current (where the leaving of the work in the plating bath is unobjectionable). The meter is stated to be of wide application in silver and nicke plating; and of special value in the control of gold plating in which, on account of the relatively small amount of gold ordinarily deposited, requiring too small a current to be recorded with accuracy, it is advisable to employ two meters in series, a main and an auxiliary meter, the difference in the readings of the two meters giving high accuracy in work with this precious metal. The idea (shown in Fig. 10) is to have an auxiliary load of sufficient amount to give accurate registration on both meters. The main meter, connected with the gold bath, will register an amount greater than the auxiliary meter by the amount of current passing through the bath.

The ampere-hour meter has had an especially interesting application to electric vehicles, inasmuch as it affords a more direct, convenient and accurate method of determining the "miles in the battery" than may be arrived at by noting the readings of the dashboard ammeter and voltmeter in the pleasure vehicle or truck. Practical economy in operating electric vehicles or electric boats and safety to the propelling battery alike demand a method of determining the condition of the store of electrical energy carried by the vehicle which will be within the intelligence or skill of the driver. For example, in the case of the electric truck, whereas the electrically informed or more than ordinarily careful driver may follow accurately the condition of his battery by conscientious observations of his dashboard instruments —particularly the voltmeter, which shows the gradual falling off of the electromotive force of the battery—the careless or incompetent driver, unable or unwilling to go by the indications of these instruments, may easily be stalled far from his garage for lack of current or may easily run out his battery or over-discharge it with disastrous results.

The Sangamo auto-type meter (Fig. 7) is designed to eliminate all this trouble, by affording a continuous record of the actual ampere-hours (virtually the miles) available in the vehicle battery during every trip, and it does this by integrating the energy discharge of the battery and showing the progressive lowering of total energy in the battery by a pointer which sweeps over a scale calibrated in ampere-hours. The meter is permanently attached to the dashboard of the vehicle, and permanently connected in the battery circuit. As used with the Edison vehicle battery by the Lansden Company, in charging the battery in the garage the pointer is moved over the scale in one direction registering the energy stored in the battery until the full charge has been put in. On starting out on a trip the pointer therefore shows the driver the total ampere-hours available in his battery; and as the vehicle travels over its route the pointer moves *backward* over the scale, showing a progressively diminishing number of ampere-hours left in the battery, until the arrival of the pointer at the zero indicates the limit of discharge of the battery. Most electric-vehicle manufacturers prefer to use the meter operating the pointer in the reverse direction from that explained above so that as the battery is discharged the pointer moves up the scale, moving back to the zero on charge. This arrangement allows the use of a contact at the zero point which may be employed to trip a circuit-breaker when the battery is fully charged.

The internal design of the auto-type meter is the same as that of the electroplating ampere-hour meter shown in the elementary diagram, Fig. 9. Special features included in the meter are: a differential shunt, which causes the meter to run either faster on discharge than on charge, or slower on charge than on discharge, at a ratio proportional to the current efficiency of the battery; a set of totalizing dials which gives a continuous record of *either* energy input or energy consumption (but not of both, of course), independent of the large trip pointer; a maximum-discharge pointer, which may be set at any point on the large or mileage dial for the convenience of the ve-

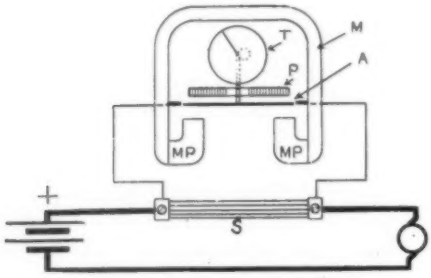


Fig. 9.—Diagram of Ampere-Hour Meter for Electroplating and Vehicles.

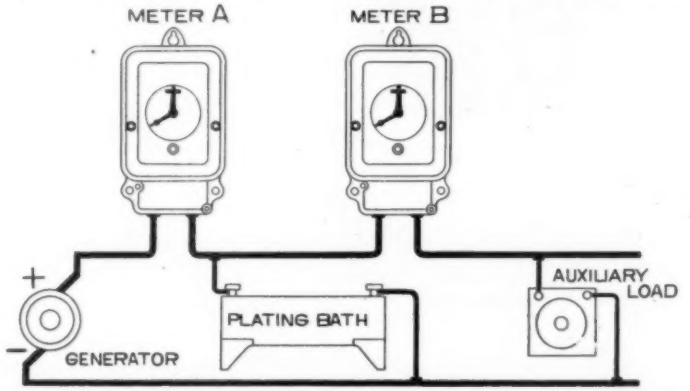


Fig. 10.—Two Meters Arranged for Measurement of Gold-Plating Current.

hicle driver as a reference point or limit for his drafts on his battery in operating the vehicle; and a re-setting device for setting the indicating pointer ahead any desired amount to allow for the percentage difference between energy output and energy input of the battery in the case of simple (non-differential) shunt meters. The re-setting device is also used in connection with the differential shunt meters in giving the battery the periodical overcharge recommended by the battery makers.

The ampere-hour meters may be furnished with a "duplex recording train" having one set of dials for indicating the charging current and another set of dials for indicating the discharge current. One of the two trains may be geared to read in kilowatt-hours direct, assuming a constant voltage on the circuit. The duplex train meter is in use by the United States Navy in submarine torpedo boats, for giving the actual loss in the propelling battery (employed for propelling the craft when the latter is submerged) during any stated period by the difference in the readings of the two recording trains.

Chicago Section, Illuminating Engineering Society, Discusses Reflectors.

A meeting of the Chicago Section of the Illuminating Engineering Society was held on the evening of February 22, in the Great Northern Hotel, Chicago. In the absence of Chairman Schuchardt, A. J. Morgan presided. The meeting proper was preceded by a dinner. On opening the meeting shortly before eight o'clock, Secretary Edward Wray announced that the board of managers had appointed J. R. Cravath as representative of this Section on the Section Development Committee, and T. H. Aldrich, chairman of the Membership Committee. An amendment to the constitution, requiring each section to have five managers instead of two, as heretofore, necessitated the election of three additional managers; those elected were J. R. Cravath, T. H. Aldrich and J. W. Foster.

The main topic for discussion was the paper by Arthur J. Sweet and L. C. Doane, on "The Choice of Reflector—Its Influence upon Illumination Efficiency and Depression in Visual Function." After a few preliminary remarks by Mr. Sweet, L. C. Doane presented an extended abstract of the paper. In our issue of February 17, page 331, an abstract of the paper was given as it was presented before the New York Section of the Society.

The discussion was opened by J. R. Cravath, who said that the efficiency determinations of the paper were unique. In applying the results, however, care should be taken to apply them only for conditions similar to those of the tests. He was glad to see flat reflectors condemned. There should have been developed some time ago another name for what the authors had called light-density opal, agreeing that this material was unsuitable for reflector purposes, although excellent for diffusing. He was also glad to see that specular reflection from paper is coming to be recognized as an evil. He questoned whether results obtained by low-intensity tests can be applied under normal conditions. As to the color of walls, he thought that the ideal office lighting would require dark walls to a height of say six feet, and light walls above this. Although the efficiency is greatest with intensive reflectors and center-of-room arrangement, this furnishes by no means the ideal lighting, because the light distribution is far from uniform. Shadow effects must be seriously considered in any lighting, particularly the lighting of offices. The color of walls does make considerable difference in the efficiency when extensive types of reflectors or indirect and semi-indirect lighting systems are used. He felt that the acuity tests were not typical of ordinary office work, such as reading or writing at a desk.

T. H. Aldrich asked a number of questions, particularly with regard to details of the test methods which had been omitted from the paper for the sake of brevity. He thought that in the tests the walls should have been somewhat darker in the lower part, as is usual in office practice. He has found after extended trial with both direct and indirect systems that employees usually favored the latter as being conducive to comfortable visual work. He has found that proper maintenance requires that direct-lighting equipment should be cleaned at least twice a month, just as any indirect equipment. Therefore, each costs about as much as the other to maintain. Moreover, the loss from failure to clean properly is about the same in each system. He felt that this is a matter that is very seriously neglected. Proper cleaning of the lighting equipment is necessary, no matter what system is used. In modern offices there is but very little exposed wall space, so that relatively little light is reflected from the walls. Light-density opal reflectors have come into very extensive use largely because they can be hung lower without causing a glare and also because of esthetic reasons.

F. A. Vaughn highly commended the work of the authors in their exhaustive investigation and very complete paper. He thought that their classification of opals has considerably clarified the situation and removed an element of mystery that has been exploited for commercial purposes. He questioned regarding the test objects and methods in the acuity tests, and hoped that tests of this character will be co-ordinated with the ideas of ophthalmologists. Considerable work of this character is to be undertaken in detailed study of schoolroom lighting, and it was desirable therefore that it be done on thoroughly scientific grounds. In this connection it has been advocated to use matt paper for school books, even if this would require the leavng out of half-tone illustrations.

F. Price spoke of the difficulty frequently experienced in office lighting from cross lights. He had advocated in a number of cases that but one type of lighting be used at a time, that is, daylight should not be mixed with artificial light. In fact, in many instances it was highly desirable to pull down the blinds or shades to secure uniform lighting results.

A. J. Morgan said that if an indirect artificial lighting is used he thought that it could be employed together with daylight without conflict, because both provide highly diffused illumination.

The discussion was closed by Mr. Sweet, who called attention to the enormous increase in the use of our eyes during the last 75 years. On account of the strenuous service that we expect from our eyes it is highly important that we should make eye-strain as small as possible by providing lighting installations as nearly ideal as we can make them. One object of his paper had been to condemn the use of light walls. If a dark dado is to be employed it will have to be carried to quite a considerable height in order to prevent bright light reflection from that part of the wall in the range of ordinary vision. It is important to remember that the matter of shadow depends upon the location of the lighting units and not upon the type of units used. He was agreeably surprised to find that indirect lighting produces as decided shadows as direct lighting, but these are almost unnoticeable because they are not sharply defined. Too much stress has been laid on uniformity of illumination. It is not imperative to provide this. Regarding the method employed in the acuity tests, it was entirely new, but had been very thoroughly investigated before being employed. If anything, it was to be criticised because it attempted to reproduce practical conditions instead of being more nearly a laboratory method. The subjects that were used in these tests had been very carefully selected, and all those with eye troubles or psychological defects were eliminated. Some question had been raised as to whether these tests could be verified at higher intensities of illumination and subsequent tests had shown this to be the case. He was convinced that ophthal-

New Electrical and Mechanical Appliances

Patterson Battery Sets for General Building Installation.

The Patterson battery set, as manufactured and developed by Stanley & Patterson, New York, N. Y., presents a distinct and important advance in battery installation for building work. It is safe to say that this battery will be vastly influential in popularizing and increasing the use of dry batteries all over the country, not only in fields where dry batteries have heretofore been used, but in many new fields where the use of dry batteries has never been thought possible. Briefly, on this latter point, it may be mentioned that the multiple-service battery sets as manufactured under the Patterson patents will even do the work of a motor-generator set, and with the wide range of adaptability to building installations must particularly appeal to the architect and engineer because of their great convenience and flexibility.

For a little over two years, Patterson battery sets have been made in large quantity and have been widely distributed, both in this country and abroad; the models designed and manufactured have, however, been those particularly suited for motor boat and automobile ignition. It is only within the last three months that the manufacturers have designed and placed on the market a line of battery cabinets for building-construction installation, but with this building-type line now developed, no one can fail to be attracted by its convenience, reliability and positive points of advantage.

The principle on which is based the advantage of the Patterson battery is

Fig. 1.—Columbia Cartridge Unit.

the suspension of the screw-threaded top cartridge dry cell, as shown, from a plate of hard rubber, on which are provided screw cup fittings to receive the cells.

Cartridge screw-top cells are now regularly manufactured in large quantity by the National Carbon Company, of Cleveland, Ohio, which holds an exclusive license under the Patterson patents. No one can deny that threading the upper section of the zinc cup of a dry battery and providing a simple, strong receptacle in which springs will automatically but unerringly make the contacts required is just the plain common-sense method of doing something right. It is all very simple, as is the case with most inventions after they have been thought of. The Patterson screw-top cell and the various battery sets which have been developed from it, constitute a practical everyday way of installing the battery that will make it appeal to the engineer and layman alike. Circuit wires need never be disturbed, for once connected to the battery set they never have to be touched; and renewing a set of batteries is as easy as putting in so many incandescent lamps and can not be done improperly by an inexperienced person. The battery sets are virtually "fool proof."

The special claim is made that the multiple-service Patterson battery sets will give several times the service obtainable from the old-style battery for two good reasons, as follows:

(a) All contacts are positively made in the hard-rubber base of the holder, without any loss of power in the connections between the cells, as was always the case with wires and binding posts.

(b) Each row of cells connects by an automatic switching device to the side busbars of the cabinet. From the terminals at the end of the busbars such an increased capacity in amperage is available that the power and life of the battery set are increased many fold.

There are four general types of Patterson battery sets of the wall-cabinet pattern, all with multiple-circuit connections:

(a) Surface cabinets—quartered oak, mission oak, whitewood.

(b) Flush cabinets—polished quartered oak.

(c) Surface steel—standard finish dull rubber-black enamel.

Fig. 2.—Model Flush Oak Cabinet, Combination Circuit.

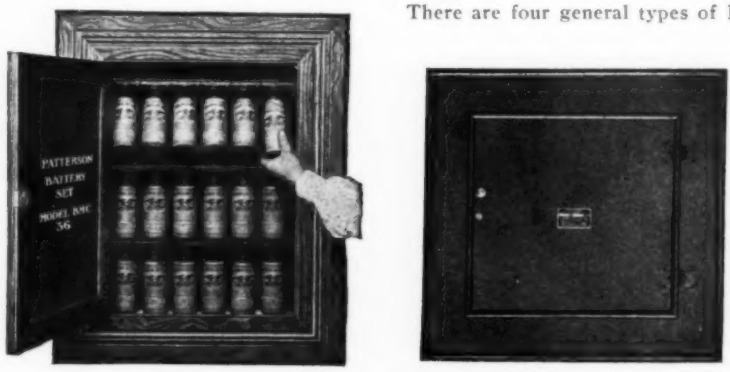


Fig. 3.—Flush Oak Cabinet and Flush Steel Cabinet for Patterson Battery Sets.

(d) Flush steel — standard finish dull rubber-black enamel.

For new building installations the makers recommend the flush type cabinets, either of steel or oak, as superior to the surface type, and recommend that they be specified wherever possible. But for old buildings, where it is not convenient to cut in a flush cabinet, the corresponding surface type should be used.

Fig. 4.—Surface Oak Cabinet.

In a recent catalog Stanley & Patterson give examples of the advantages of the various sets and explanations of their uses. The reader of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN interested in this branch of electrical work will find there much additional data that space will not permit presentation of here. Some of the more important features are described and illustrated, however, and every user of batteries will find this information of value.

The first illustration shows the Columbia cartridge cell with screw-threaded top, ready to insert in the receptacle against the contact springs.

Fig. 2 shows a flush oak cabinet of combination-circuit pattern designed to permit, by simply turning the switch handle and reading dial of the switch, any combination of circuits that could possibly be required for the satisfactory operation of electrical apparatus in a building.

Two-row sets may be run multiple-series, or, the upper set may be held in reserve and the lower set cut into the circuit, or vice versa. As a fourth combination, if through long service, the voltage of the set should be down to a point where electrical devices in the building are not operating satisfactorily, switch may be turned "All-Series," giving, with a lot of weak cells, approximately normal voltage obtainable from the set at multiple-series when cells are new; when this emergency all-series connection becomes necessary, a new set of cells should be procured as promptly as possible.

Four-row sets have the same circuit combinations as the two-row sets, but with the dial reading "Multiple-Series," the capacity of the set is 80 to 100 amperes, and when either set of two rows is cut out, there is still available capacity of 40 to 50 amperes.

In Fig. 3 are shown a flush oak cabinet and a flush steel cabinet, the latter closed. They are regularly made in the same capacities as the surface types, and larger sizes will be made when ordered.

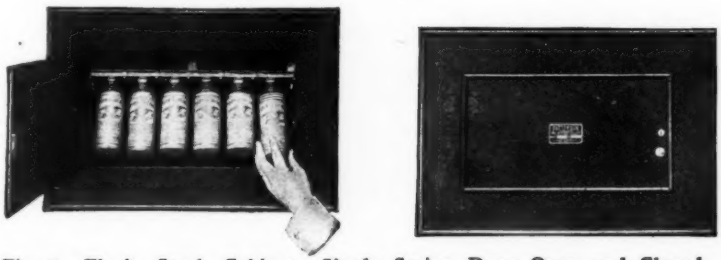


Fig. 5.—Flush Steel Cabinet, Single Series, Door Open and Closed.

In Fig. 4 a special battery set, residence pattern, is shown, and is intended for use where normal requirements, such as the operation of annunciators, signal bells, etc., obtain. One particularly pleasing advantage to every householder, and one that always appeals to the lady of the house, is the fact that the setting up or renewing of cells can be done by the most inexperienced person. The circuit wires never have to be disconnected.

Fig. 6.—Telephone Set.

Fig. 5 shows a flush steel cabinet with door closed and open. This is a battery set designed for use in the smaller high-class residence, where the demand is comparatively light. The single-series set will, for this light work, often meet the requirements.

The circuit wires never have to be disconnected,—automatic bridges in each cell receptacle permit the removal of a cell without opening the circuit. The battery strips themselves are of hard rubber with phosphor-bronze contacts.

In Fig. 6 is shown a Patterson telephone battery set for heavy-service intercommunicating telephone work. In the illustration the battery is shown "split" so that at the terminal binding posts on the upper and lower ends of the busbars there is available for the talking circuit the voltage of the three left-hand cells (four and one-half volts), and the amperage of two sets of left-hand cells (fifty amperes). For the ringing circuit there is available at the two right-hand terminal binding posts the voltage of the four right-hand cells (six volts), and the amperage of the two sets of four right-hand cells (fifty amperes). When this telephone battery is installed, circuit connections to both talking and ringing terminal busbars are made, and, when once made, do not have to be disturbed. From that time the renewal of the battery set can be made by any person, without tools of any sort, and without the slightest technical knowledge.

In Fig. 7 the cellar or closet type of Patterson battery set is shown. This is designed for installations where the work is light and where the minimum of expense is desired. The set is of the single-series type, but gives very efficient service for light work. In the illustration the front is down, giving a view of the strip-type holder, the top being raised to screw in the cells. The top of the box is hinged so that when a cell is to be screwed into position, it may be lifted up and the cartridge cell easily inserted. These outfits are designed to be attached to a side wall or partition, but, if more convenient, the box can easily be fastened to the ceiling. The hardware fittings are galvanized and will not rust even when installed in a damp cellar.

Fig. 8 shows a strip-type battery holder. These are best when mounted on a back-board with permanent terminals on the board for attaching circuit wires. In the illustration is shown a knife-blade contact arrangement, permitting raising of the strip for the easy insertion of cells.

Figs. 9 and 10 show various types of battery holders.

Patterson battery sets are made in all sizes, from the simple strip-type holder carrying two cells up to the multiple-service panel-board battery sets of a capacity of nine volts, 150

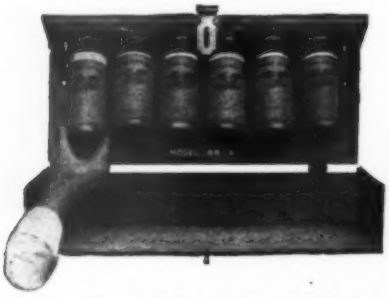


Fig. 7.—Closed Type, Showing Holder Raised to Screw in Cells.

amperes. The latter sets are adapted to the most severe work, and will do the work of a motor-generator with perfect satisfaction.

Multiple-service sets are provided

Fig. 8.—Strip-Type Battery Holder.

with individual circuit fuses, so that in addition to the advantages of centralized battery and the economy of use in multiple, an acci-

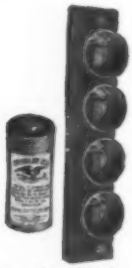


Fig. 9.—Skeleton Hard Rubber Sectional Strip Type.

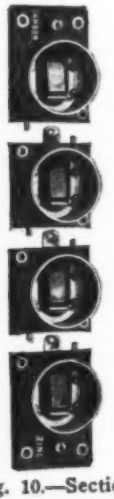


Fig. 10.—Sectional-Unit Type, Showing Unit Construction.

dental short-circuit on some line can not put the battery out of commission. With these individual circuit fuses with which multiple-service cabinets are equipped, each individual circuit is protected by a standard fuse plug. If an accidental short-circuit occurs, the fuse blows and cuts out the circuit where the "short" occurred, and leaves all other circuits in operative condition.

A New Line of Motor-Starting Rheostats.

The Electric Controller & Manufacturing Company, Cleveland, O., has recently placed on the market, a new line of starting rheostats for series, shunt, or compound-wound, direct-current motors. The manufacturers claim the following important advantages for these rheostats:

The highest grade of Monson slate

Fig. 1.—Motor-Starting Rheostat for Small Motors.

is used, having beveled edges and oil finish.

On all sizes the contacts are removable from the front of the rheostat.

The retaining magnet is iron-clad, thus being protected from mechanical injury.

The resistance wire, the capacity of which is liberally proportioned, is wound on asbestos-covered, metallic tubes through which a draft of air flows. While this draft of air very efficiently conveys the heat away from the resistance it does not at any time touch the hot resistance wire, the obvious result being unusual freedom from oxidation of the resistance wire.

The E. C. & M. motor-starting rheostats are regularly furnished in sizes from one-quarter horsepower to 35 horsepower, 110 volts, and from one-quarter horsepower to 50 horsepower, 220 and 550 volts.

Starters similar to that shown in Fig. 1 will be supplied for motors up to and including seven and one-half horsepower, 110 volts, 15 horsepower, 220 volts, and 20 horsepower, 550 volts. For larger sizes, the starter will be similar to that shown in Fig. 2.

The Duluth Log Company.

The Duluth Log Company, Duluth, Minn., is one of the largest producers of cedar products in the country. The company maintains extensive stocks in fourteen yards advantageously located for the prompt filling of orders. The principal cedar yards are at Duluth, Minn., on the Northern Pacific, Great Northern, Chicago, Minneapolis & St.

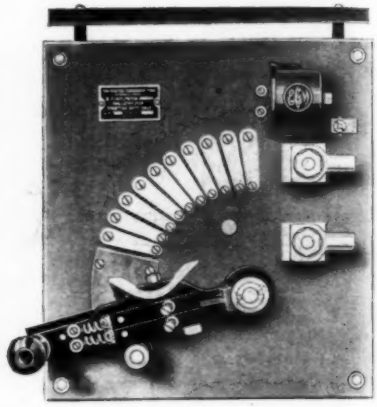


Fig. 2.—Motor-Starting Rheostat for Large Motors.

Paul, Minneapolis, St. Paul & Sault Ste. Marie, and Chicago, St. Paul, Minneapolis & Omaha Railways; mill yards at Aitken on the Northern Pacific, Minneapolis, St. Paul & Sault Ste. Marie; mill and yards at Hawthorne, on the Chicago, St. Paul, Minneapolis & Omaha Railway; Deer River, on the

Partial View of One of the Yards of the Duluth Log Company.

Great Northern; Remer and Swatara on the Minneapolis, St. Paul & Sault Ste. Marie; Northome, Funkley, Black Duck, Little Fork and Big Falls on the Minnesota & International Railway.

The officers of the company are E. L. Bradley, president and treasurer; and T. B. Bradley, secretary and general manager.

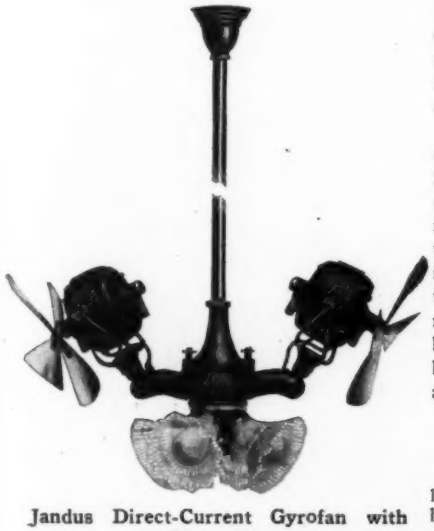
Electric Fan Motors for 1912.

Adams-Bagnall Electric Company.

A complete line of Jandus fans is manufactured and sold by the Adams-Bagnall Electric Company, Cleveland, Ohio. These fans are offered in all sizes and all types for use in the store, the bank, the restaurant, hotel, office and home. The line includes the standard desk, bracket and oscillating types and a special feature is the popular Gyrofan. This fan is designed along scientific lines and is based on the principle that atmosphere like water must be constantly in motion or it becomes stagnant, impure and uncomfortable. The Gyrofan is so constructed that it sets in motion the entire atmosphere of a room and maintains a constant circulation of pure, cool air throughout instead of blowing a strong blast downward and within a small area.

Jandus fans are made for both direct-current and alternating-current circuits, and outside of a considerable vogue in the home and office have been adopted by practically all the leading railroads and steamship lines throughout the world.

Jandus Direct-Current Desk and Bracket Fan.



Jandus Direct-Current Gyrofan with Electrolier.

Century Electric Company.

The Century Electric Company, St. Louis, Mo. is offering a complete line of alternating-current fan motors of the split-phase induction type. This line includes the 16-inch desk and wall bracket fan, the 16-inch oscillating desk and wall bracket fan, the 12-inch desk and wall bracket fan, the 58-inch ceiling fan and 58-inch ceiling fan with electrolier.

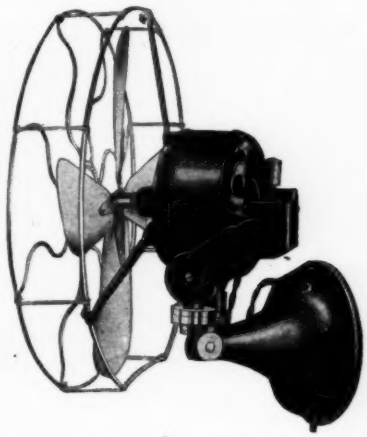
Century Alternating-Current Desk and Wall Bracket Fan.

The oscillating mechanism of the Century fans is of high efficiency Spur gears are used to effect the speed reduction. These gears are operated in a greased pocket; the weight of the fan motor is carried on ball bearings so that the friction loss through the oscillation is reduced to a minimum. When the fan is tilted from a horizontal adjustment throughout it has 120 degrees of oscillation and the air is blown in the same plane.

Colonial Fan & Motor Company.

The Colonial Fan & Motor Company, Warren, O., announces a number of improvements in its line of direct-current and alternating-current fans. While the eight-inch fan is not a universal fan, the alternating-current type is of the same general construction, it being a commutator type, series-wound fan, built similarly to the 12-inch and 16-inch fans, as to universal joint, cast hoods, etc. It will be equipped with improved brush holders.

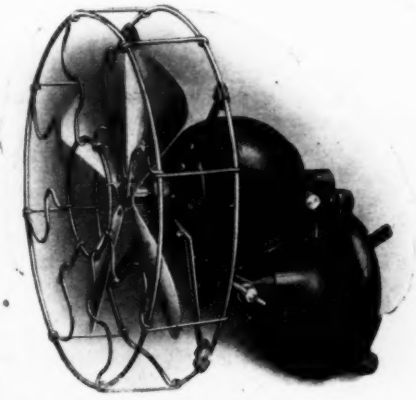
The 12-inch and 16-inch universal alternating-current and direct-current desk fans will be of the same construction as last season, the direct-current fans having three distinct speeds, and a cut-out, the alternating-current fans having two distinct speeds and a cut-cut, the variation between first and second speeds being greater than that which was found in last year's models.



Century Oscillating Desk and Wall Bracket Fan.

The oscillating fan, with universal joint, will be of the worm-gear type, and will oscillate only one-half as fast as it did last year.

The line will include eight-inch direct-current universal desk or bracket; 12-inch and 16-inch direct-current universal desk and bracket; 12-inch and 16-inch direct-current bracket; 12-inch and 16-inch direct-current universal



Colonial Direct-Current Oscillating Bracket Fan.

oscillating; 12-inch and 16-inch oscillating bracket; direct-current ornamental-type electrolier and direct-current plain-type ceiling fans with long blades; 8-inch, 12-inch, and 16-inch alternating-current universal desk and bracket, and 12-inch and 16-inch alternating-current oscillating fans.

Diehl Manufacturing Company.

The line offered by the Diehl Manufacturing Company, Elizabethport, N. J., represents the result of over twenty years of experience in the manufacture of fans, the first Diehl fans having been introduced to the public in 1889. The line includes universal desk and bracket fans of the swivel and trunnion type, for both direct and alternating-current circuits, in 12-inch and 16-inch sizes. The 8-inch residence and telephone-booth type for both direct and alternating current are made as convertible desk and bracket fans.

The residence type of fan is adjustable vertically through a wide range and may be secured at any position by a thumb screw. The telephone-booth type is suspended on springs which prevent vibration, and cause the fan to run noiselessly. The universal oscillating fans for direct-current and alternating-current circuits are made in the 12-inch and 16-inch sizes. The Diehl oscillators are provided with the universal feature, the divided ball joints having corrugated steel washers on their faces, allowing adjustment to any desired angle by means of a wing-screw.

In ceiling fans the Diehl Company offers the four-blade type, plain and ornamental, and the two-blade type, plain and ornamental, for both direct-current and alternating-current circuits.

This company also offers an attractive column fan for alternating-current circuits.

Colonial Direct-Current Ornamental Ceiling Fan.

Emerson Electric Manufacturing Company.

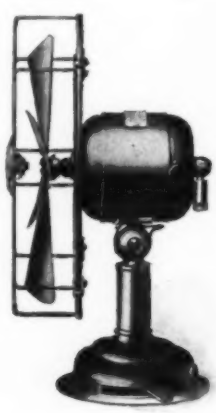
A number of new types of Emerson fans for direct current are offered for the season of 1912. These include 8-inch, 12-inch and 16-inch swivel-trunnion fans, 12-inch and 16-inch oscillators and the popular residence-type slow-speed swivel-trunnion and oscillating fans for direct current. The line of Emerson fans is accordingly more complete than ever before.

Important improvements in alternating-current desk fans enables this company to offer a complete line of three-speed induction desk fans in the swivel-trunnion and oscillating styles. With one or two exceptions these three-speed fans are all new types.

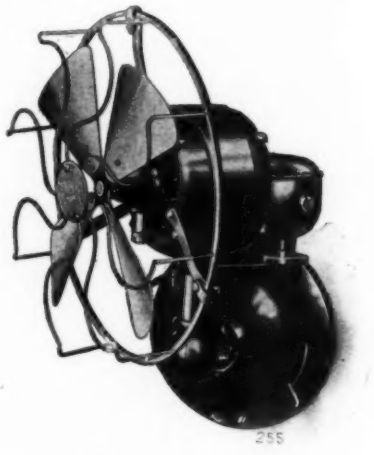
These new three-speed Emerson and Trojan induction desk and oscillating fans embody the important distinctive features which have contributed to the success of this company's fan product in past years. The value of the new features found in these three-speed fans has been demonstrated on the 8-inch and residence-type Emerson fans made during 1911.

Emerson and Trojan ceiling and column fans for alternating current are the same satisfactory types known to the trade during the past season with such minor detailed improvements as have been found possible through improved manufacturing methods and careful study of the performance of fans in service.

The Emerson bedstead and elevator-type 8-inch fan can now be furnished for direct current as well as alternating current, and it is expected that the usefulness of this type will be greatly extended, since it is available for hotels operating isolated plants.



Diehl 8-Inch Residence-Type Desk Fan.

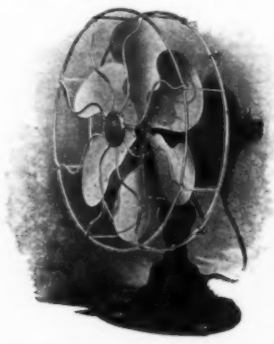


Diehl Alternating-Current Oscillator Bracket Fan.

The six-blade, small-sweep, low-priced ceiling fan first offered last season is again listed for 1912, as its value was demonstrated for numerous special forms of service, such as bakeries, candy shops, etc.

To these desirable features may be added the improvement in alternating-current desk and oscillating fans in the application of the three-speed feature without moving contacts or mechanical starting devices. Another valuable feature is that all wearing parts of oscillators may be renewed without returning the fans to the factory.

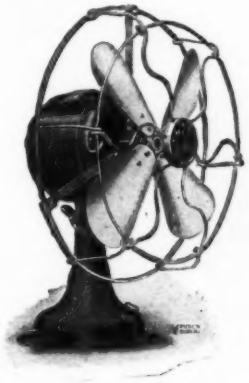
Emerson 12-Inch Swivel-Trunnion Desk Fan.



Emerson Residence - Type 12 - Inch Oscillator Fan.

General Electric Company.

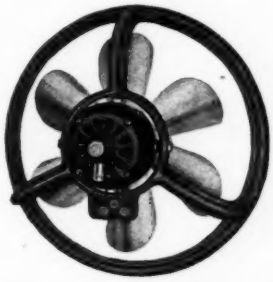
The General Electric line of fans for 1912 covers both desk and oscillating types in the 8, 12 and 16-inch sizes, direct current, and all frequencies alternating current. The standard voltages are carried in stock, odd voltages up to 250 volts may be furnished on order in any rating. The eight-inch fan is not furnished for frequencies above 60 cycles.



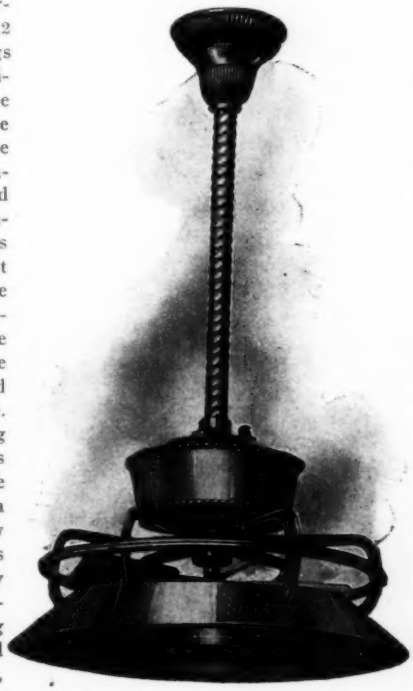
General Electric 8-Inch Desk Fan.

This line of motors follows in appearance and general features of construction the models of the preceding year. In many important details, however, decided improvements and refinements in design have been incorporated. The entire line of fans for 1912 has self-aligning, ball-seated bearings with ample wick lubrication and definite oil deflectors and passages for the return of grease from the shaft to the grease cup. The attachment of the base plate, which has been much improved, is held on by one screw and the fiber insulating plate is reinforced by a thin steel plate. All sizes and frequencies of alternating-current motors are of the induction type, free from moving contacts or brushes, furnished with a resistance-reactance type of winding, having an extra resistance wound in one phase of the field and external reactance in another phase. This gives not only good starting torque, but when left in circuit gives an efficient winding and a flexible torque speed characteristic, allowing a control of these motors to a very low speed and the obtaining of first-class starting characteristics without any centrifugal switch or change in connection between starting and running conditions. This feature has been used in the main from two to three years, but only during the past year has the proportion of windings been worked out to perfection so as to give the very best results.

The oscillating motors have a positive oscillating mechanism with worm and gear speed reduction, using accurate die cast parts for the frame work. In the main features these are duplicates of the mechanisms which gave positive success last season. Detail changes have been made, however, in the construction of the various bearings throughout on oscillating mechanism so that the dripping of oil or grease is either absolutely prevented or wherever this is impossible, a chamber is provided for catching and storing the drip. The 12 and 16-inch oscillators have two angles of oscillations and a simple gear change device which will give either the oscillating position, a locked position or a free position of the fan body. The eight-inch motor may be varied in width of oscillation from zero to the maximum.

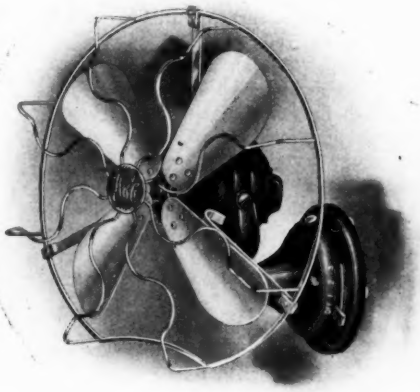


General Electric Alternating-Current Exhaust Fan.



Hunter Ceiling Deflector Fan.

The telephone booth type of fan is suspended from a bracket by springs, thus preventing the fan from affecting the operation of the telephone. The bracket arm to which the springs are attached is fastened to its base by a hinged joint by means of which the fan may be inclined to an angle of several degrees from the horizontal.



Hunter Alternating-Current Oscillating Desk and Bracket Fan.

The 12-inch, six-blade residence fans are especially designed for residence and hospital use where a quiet running fan giving a moderate breeze is desired.

The 12-inch and 16-inch four-blade fans deliver a stronger breeze than the residence fans and are for service in large offices, stores and public places.

The motors are provided with switches which permit three speeds, thus providing regulation for all purposes.

The ceiling fans can be furnished in plain or ornamental designs as desired. They are attractive in appearance and can be provided with electrolier fixtures if desired, as all ceiling fans are wired for lights.

Alternating-current ceiling and column fan motors are designed for operation on 25, 40, 50 and 60-cycle circuits. The plain type has two speeds, while the ornamental has three running speeds.

The direct-current ceiling and column fan motors are designed for 110 and 220-volt circuits; the plain type being designed for one speed only, while the ornamental type are designed for single and three speeds.

The Hunter Fan & Motor Company.

The Hunter Fan & Motor Company, Fulton, N. Y., offer a complete line of "Quirk" and "H E" fans for both alternating-current and direct-current circuits.

The type "A" fan is especially de-

signed for high frequencies, ranging from 50 to 140 cycles and 50 to 220 volts, and is furnished with either two or four blades, eight inches wide and 60-inch sweep, and operates at a speed of 175 revolutions per minute. The blades of this fan can be adjusted at will while the fan is in motion, thus regulating the air circulation without changing the speed. Electrolier attachments may be connected for two, three, four, five or six lamps as desired.

The type "C" fan has a slow speed induction motor. This is supplied for use with four blades, the blades being permanently fixed at a correct angle to the revolving rotor. The four blades are six and one-half inches wide at the tip and have a 52-inch sweep, at 225 revolutions per minute. The type "C" fan is particularly adapted to frequencies of 25, 50 and 60 cycles. Electroliers for two or four lamps can readily be attached.

The type "C O" is highly artistic and ornamental in appearance, is equipped with four blades, and arranged for electrolier attachments.

The type "E" fan is furnished with four blades eight inches wide, with a sweep of 60 inches. The blades are permanently fixed at the proper angle and placed above the motor body, which is arranged for two or four-lamp electrolier attachment.

The type "F" floor column fan is equipped with four six and one-half-inch blades, with a 52-inch sweep. Either two or four-lamp electrolier may be attached.

The "H E" type "H" desk and convertible wall bracket fans are designed for frequencies ranging from 25 to 133 cycles, and voltages from 100 to 220, and are equipped with four polished brass blades, 12 inches and 16 inches in diameter. The motor is of the high-speed induction type.

The "H E" type "I" oscillating fan is especially designed for frequencies of from 25 to 133 cycles, and voltages from 100 to 220, and is equipped with four blades 12 inches and 16 inches in diameter.

The "H E" type "Q" eight-inch convertible wall bracket fans are designed for frequencies from 25 to 60 cycles, and voltages from 100 to 220, and are equipped with four blades 8 inches in diameter.

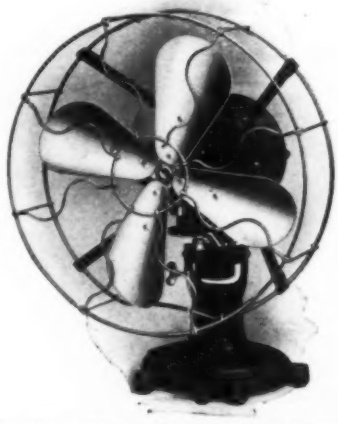
The "H E" types "J" and "K" direct-current ceiling fans are furnished with either two or four blades, 8 inches wide with a 56-inch sweep. The blades are permanently set at the proper fixed angle and are carried by malleable iron blade holders.

The "H E" type "S" direct-current fans are made in 12-inch and 16-inch sizes, with swivel and trunnion frame for desk and wall bracket mounting.

The "H E" type "T" direct-current 12-inch and 16-inch oscillating fan motors are wound for 100 to 220 volts, for either desk or bracket mounting.

The types "O" and "W" alternating and direct-current small ventilating outfits have a distinctive field of their own for ventilating small areas where it is impossible to make use of the larger direct-driven exhaust wheel, such as offices, kitchens, toilets, small private dining rooms, cellars, vaults, etc. They can be used for exhausting foul air or supplying fresh air in numerous places. Speed regulators can be supplied when desired.

Peerless Direct-Current Ceiling Fan with Electrolier.



Peerless Direct-Current Oscillating Fan.

The type "D" alternating-current and direct-current deflector ceiling fan is unique in construction, giving an even distribution of air under positive control. This is for use particularly in banks, dining cars, private dining-rooms and restaurants.

Peerless Electric Company.

The Peerless Electric Company, Warren, O., is placing before the trade a line of fans in which excellent electrical and mechanical designs are manifest features. Handsome finish is a characteristic and the types are so varied as to meet every demand. All Peerless fans, including the oscillator and eight-inch, are universal, and readily convertible from desk to bracket position without the use of adapters.

The type "BB" alternating-current universal fans are of the induction type, self-starting, having no commutator or brushes. This fan consumes 35 watts in the 12-inch size, and 70 watts in the 16-inch size at full speed.

The type "FF" alternating-current oscillating fans are of the self-starting, single-phase, induction type, equipped with the Peerless universal swivel and trunnion device.

The type "AA" alternating-current eight-inch fan is a quiet-running, powerful little motor weighing less than five pounds, and consuming only 18 watts at its greatest speed.

Peerless buzz fans include type "EE" direct-current universal fans and type "ODD" direct-current oscillating fans. The Peerless positive drive oscillator for this season embodies a number of improvments over last year.

Type "HH" direct-current ceiling fans are handsome in appearance, and are equipped with four blades, with 56-inch sweep. The motors are wound for 110, 170, 220, 250 and 500 volts. The type "CC" direct-current ceiling fans are electrically and mechanically similar to type "HH" and differ only in external appearance.

Type "JJ" direct-current column fans are for hotel and restaurant use. These are substantially built and supplied in finishes to harmonize with surroundings.

Peerless direct-current ventilating fans may be furnished with either propeller or straight blades. These outfits are built in sizes from 18-inch to 48-inch sweep.

Small direct-current and alternating-current ventilating fans are furnished in 12-inch and 16-inch sizes. The frame ring supports the entire outfit.

Robbins & Myers Company.

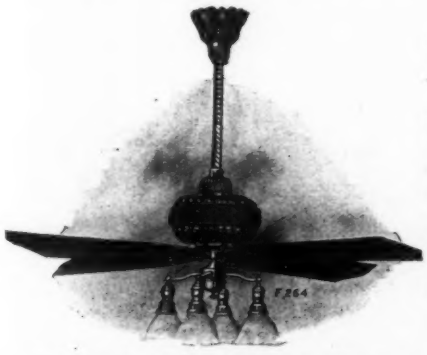
The Robbins & Myers Company, Springfield, Ohio, is offering for 1912 a complete line of alternating-current and direct-current ceiling, desk and oscillating fan motors. The fans are designed for all standard voltages and frequencies.

The line includes 8-inch, 12-inch and 16-inch alternating-current and direct-current desk and wall bracket types of fans, 12-inch and 16-inch alternating-current and direct-current oscillating fans, 12-inch and 16-inch alternating-current and direct-current exhaust fans, and the well known line of direct-current ceiling fans with the addition of

Robbins & Myers 16-Inch Oscillating Wall Bracket Fan.

the Style E ornamental and the Style F plain types of alternating-current ceiling fans.

The alternating-current Model 14 desk and the Model 11 oscillating fans employ a special form of winding, eliminating the troublesome centrifugal switch and the consequent burn-outs of the starting winding when this switch fails to operate. This form of winding was thoroughly tried out last season on the Model 14 and proved very popular. This winding in connection with the special method of riveting the field punchings eliminates all noise and makes a very quietly running fan.



Robbins & Myers Alternating-Current Fan with Electrolier.

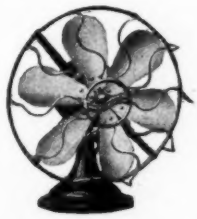
The Model 11 geared-type oscillator, which is offered for the second season, is furnished for both direct and alternating current. The reduction mechanism consists of a double worm and wheel train inclosed in an oil-proof box and moving the fan from side to side by crank disk and pitman operating in a horizontal plane. This pitman or connecting rod swings at one end upon a hardened-steel stud fastened to a stationary support, and at the other end upon a crank pin adjustable to and from the center of the crank disk for the purpose of regulating the angle of oscillation.

The fan is universal in its adaptability. The ball-bearing spindle on which the motor turns from side to side is mounted in a joint in the top of the base, which allows it to be adjusted to any proper range or elevation and to be instantly converted from desk to wall bracket type or vice versa. A number of properly spaced countersinks in the swinging joint provided for seating the screw which is in the side of the base, secures this adjustment.

The Styles E and F alternating-curretn ceiling fans employ the same type of winding as the alternating-current desk fans. The motors are strongly constructed throughout, very durable and practically noiseless. The fan blades are mounted on a spider directly beneath the motor, which gives the benefit of the full sweep.

Western Electric Company.

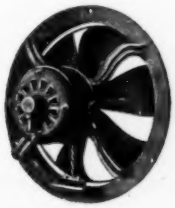
One of the most marked improvement in any of the 1912 fans is that



Western Electric 12-Inch Desk and Bracket Fan.

introduced in the construction of the Western Electric 12 and 16-inch desk and bracket fan, 12 and 16-inch mechanically operated oscillating fans, and the 12-inch, six-blade residence-type fans.

In these types a drawn-steel frame instead of the ordinary iron frame is



Western Electric Small Ventilating Set.

used. This feature, which is an innovation in the manufacture of electric fans, possesses several advantages. It affords a fan of much greater strength, yet of lighter weight, the drawn-steel fans being from 20 to 40-per-cent lighter than iron fans of the same types and sizes.

Another advantage possessed by drawn steel over the iron frames is in the finish. The steel frame lends itself to a variety of finishes, such as statuary bronze, mottled copper, polished brass, brushed brass and nickel.

The surface of the drawn steel is smooth and lustrous, giving an effect that cannot be obtained in fans of cast-iron frames.

The graceful lines and harmonious appearance of these fan motors can be

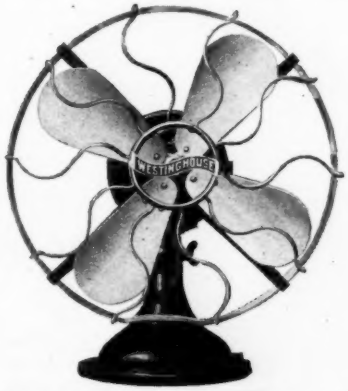
Western Electric 32-Inch Alternating-Current Ceiling Fan.

readily appreciated from the accompanying illustrations.

In addition to the drawn-steel types of fans, the Western Electric Company has also added to its already complete line a new 32-inch alternating-current ceiling fan, which is furnished in black enamel, white enamel and mottled copper.

Westinghouse Electric & Manufacturing Company.

This year sees a marked change in



Westinghouse 16-Inch Desk and Bracket Fan.

construction as offered by the Westinghouse steel-frame 12-inch and 16-inch desk and bracket fan motors for alternating and direct-current circuits. This change in design and construction represents unquestionably the greatest advance in fan-motor construction.

The motor frame, the base and the guard arms are made of drawn steel, which combines great strength with minimum weight; these fan motors

weigh from 20 to 40 per cent less than cast-iron-frame fan motors of corresponding sizes.

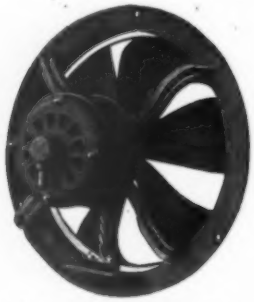
Another special feature of these fan motors is the swivel-and-hinge joint which connects the motor and the base. By means of this joint the fan can be tilted within 105 degrees or rotated within 340 degrees in any direction and can be changed from desk

Westinghouse 32-Inch Alternating-Current Ceiling Fan Motor.

to bracket mounting without the use of a trunnion, tools, or an adapter.

All 25-30, 50 and 60-cycle fan motors have three speeds and there is a marked difference in the effect of the fan at each speed.

The motors for the drawn-steel fans are of new design and have been made very efficient, showing an unusually low current consumption for the amount of air removed. This has been accomplished without sacrificing the air output.



Westinghouse Alternating-Current Exhaust Fan.

The fan blades are the standard design, selected after years of trial, and generally adopted for fan-motor use.

Series-wound motors are used for 25-30-cycle fan motors. Imported brushes of large area and the best quality are used.

These fan motors have a heavy felt base, which is firmly clamped in place, similar to a desk telephone.

The residence fan motors are practically noiseless in operation. They have six blades and the motors are slow speed. They are built in three types; desk-and-bracket, mechanically operated, oscillating and air-operated oscillating.

A new line of mechanically operated oscillating fan motors in drawn-steel frames, a further development of the desk and bracket line, will be offered this season. In these fan motors the oscillating mechanism is entirely inclosed; the oscillating movement can be stopped and started while the fan is in motion; the fan can be tilted or changed from desk to bracket mounting without the use of a trunnion or an adapter; and if the fan guard strikes an obstruction during the course of oscillation, the fan merely stops oscillating without interfering with the operation of the motor so that the overturning of the fan or the burning out of the motor is certainly prevented.

Mechanically operated oscillating fan motors in cast-iron frames of the design so successful last season are again offered.

The air-operated oscillating fan motors offered this year are an improvement over last year's models. The oscillating movement is effected by means of vanes mounted in front of the fan guard; the arc of oscillation can be varied from 30 degrees to 360 degrees, in steps of 30 degrees.

The Westinghouse line for 1912 is complete and includes fan motors for every purpose and for every commercial circuit on which fan motors are used. It comprises 8-inch, 12-inch and 16-inch desk and bracket; 12-inch and 16-inch mechanically operated oscillating; 12-inch and 16-inch air-operated oscillating; 12-inch residence; 8-inch telephone booth; long-sweep and 32-inch ceiling; counter column and floor column; and 12-inch and 16-inch exhaust or ventilating fan motors.

The eight-inch fan is of drawn brass, the same construction that has been so successfully used with this type for several years past.

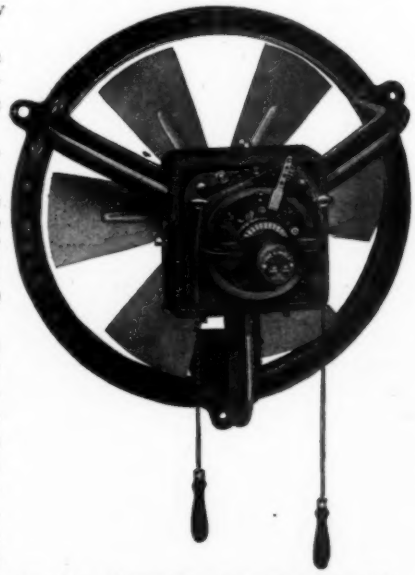
The line of ceiling fans has been extended by the addition of an alternating-current fan motor with a 32-inch sweep, designed on the same lines as the larger ones already on the market, and particularly adapted to small offices, hallways and bed rooms. The 32-inch type is furnished in two speeds in the mottled copper finish and single speed in white and black enamel finishes, a pull switch mounted outside of motor is operated by a cord hanging within easy reach. The fan has four blades of aluminum with frosted finish.

Kimble Reversible Alternating-Current Fans.

The Kimble Electric Company, Chicago, has added to its line for 1912, a new 42-inch ventilating fan. This fan is driven by a two-horsepower, single-phase, variable-speed reversible motor. Its maximum speed is 550 revolutions per minute, at which speed, it is claimed, it will move 22,000 cubic feet of air per minute.

A distinctive feature of Kimble fans is the fact that the motor is instantly reversible from any speed forward, to any speed in the opposite direction, and that the power consumed is at all times in approximate proportion to the speed of operation.

Perhaps the most striking feature of the 1912 Kimble fan motors is the fact that they will be built, if desired, with outside transformer controller, instead of the lever-and-chain control, as for merly. This change was made in or-



Kimble Alternating-Current Reversible Exhaust Fan.

der to secure a power-factor of 90 to 97 per cent.

The Kimble fan is built regularly with straight aluminum blades, that the user may realize the full air-moving efficiency, whether he operates the fan for intake or exhaust.

Another feature of the Kimble fan is the low starting current that it requires, making it feasible for installation on lighting circuits. For instance, it is claimed that the 36-inch straight-blade fan driven by a one-and-one-half-horsepower Kimble motor, moving 17,300 cubic feet of air per minute at 550 revolutions per minute, starts on four amperes, runs full speed on eight amperes, and reverses from full speed forward to full speed backward on nine amperes.

Electric Ventilating Company.

The Ilg Electric Ventilating Company, Chicago, Ill., builds propeller fans in all sizes, all speeds and for any current, voltage or frequency. The company also builds direct-connected and belted blowers and exhausters in all sizes from 25 inches to 120 inches for any current or voltage. For industrial requirements the company builds shaving exhausters, forge blowers, volume blowers, portable ventilating sets and mechanical draft apparatus.

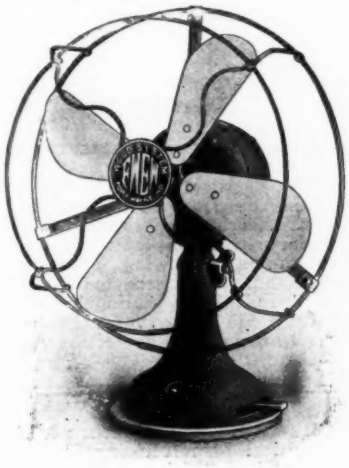
A feature of the Ilg fans and blowers is the patented method of ventilating the motor. Owing to the collection of dust or other foreign matter it is desirable to use an inclosed type of motor for exhaust fan purposes. The Ilg self-cooled fan meets this condition by employing an inclosed-type motor, ventilating it at the same time to avoid over-heating of the armature and field coils. The ventilation of the motor is accomplished by the vacuum created in front of the center, or axis, of the fan drawing air from the outside through the tube connecting with the hood which completely incloses the motor on all sides but the front. After ventilating the motor the air is carried away with the general exhaust.

Another feature brought out by this company is the Ilg automatic louver, consisting of several horizontal aluminum slats divided into a rigid frame and hanging free in front of the exhaust fan. The slats are so arranged that when hanging down they overlap each other, fitting closely.

Ilg Ventilating Set.

Fort Wayne Electric Works.

The Fort Wayne Electric Works has always endeavored to anticipate the popular demand and offer a fan to meet every need and desire.



Fort Wayne 8-Inch Desk Fan.

The fans are designed for all standard voltages and frequencies, and, while several are substantially the same in appearance as those of last season, improvements have been made in oscillating devices and other important details. The line of 8-inch fans particularly has proven to be very popular, and the company has added an 8-inch oscillating fan for which it has prophesied a great demand. The line includes 8-inch alternating-current and direct-current desk and bracket fans; 8 inch alternating-current and direct-current desk and wall bracket oscillating fans; 8-inch revolving and telephone booth fans; alternating-current and direct-current circuit six-blade swivel and trunnion frame desk, bracket and oscillating fans in the 12-inch and 16-inch sizes, and alternating-current and direct-current, four-blade and two-blade, 52-inch, plain and ornamental, floor-column, counter-column and ceiling fans, in several styles and finishes.

American Blower Company.

The American Blower Company, Detroit, Mich., is directing attention to its "Ventura" disc ventilating fans. The "Ventura" is the latest development in curved-blade, disc-fan design and construction. It runs at a high speed, has a remarkable capacity to overcome resistance, and throws the air current straight ahead. In fact, the air as it leaves the fan has a tendency to bend inward for a considerable distance before it begins to expand.

American "Ventura" Disk Ventilator.

A feature of this ventilating set is its adaptability as a supply fan or exhaust fan combined in one compact unit. The outfit includes a 12.5-inch motor-driven "Ventura" fan, housing or frame, reversing mechanism, chain wiring from motor to receptacle, complete ready for electrical connection. An ordinary lamp cord is sufficient, as the current required does not exceed that supplied to a sixteen-candlepower carbon lamp. When the motor with this outfit has reached a speed of 900 revolutions per minute the outfit expels 36,000 cubic feet of air per hour.

"Ventura" Disk Ventilator Installed.

Latest Approved Fittings

CONDUIT BOXES, COVERS FOR.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." Brass Conduit Box Covers.

Catalog No. 367 for three-inch round conduit boxes.

Catalog No. 369 for four-inch round conduit boxes.

Approved February 1, 1912.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—The Spark Electric Company, Kansas City, Mo.

"Branchlet."

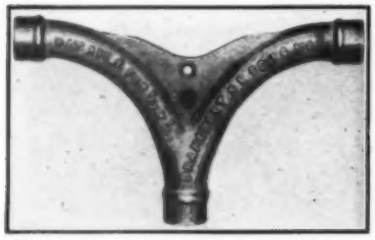
A cast-iron double elbow for use with one-half-inch rigid conduit.

Approved December 14, 1911.

INSULATING MATERIALS.—H. W. Johns-Manville Company, 100 William Street, New York, N. Y.

ASBESTOS BOARD.—A laminated product made from a wet stock and having physical characteristics similar to millboard. Used as a lining for wooden cabinets and for the protection of surfaces exposed to high temperatures.

ELECTROBESTOS.—A homogeneous product made from a relatively



"Branchlet" Conduit Fitting, The Spark Electric Company.

dry, compounded stock molded under high pressure usually in dies of special form, but also made in flat plates. Used extensively for arc shields, flash barriers or as bases for mounting current-carrying parts.

Manufacturers desiring to use Electrobestos (for small parts of electric wiring devices, especially such as require considerable mechanical strength and durability as well as the non-absorption and insulating properties of such materials as slate and porcelain), should submit samples in commercial form for test.

Approved January 31, 1912.

SIGN MACHINES.—The Eclipse Electrical Manufacturing Company, 416-418 Milwaukee Avenue, Chicago, Ill.

"Eclipse Motorless Flasher."

10, 15 and 20 amperes, 110 volts, alternating-current or direct-current. An oil-immersed switch with automatic solenoid control.

Approved February 1, 1912.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

SWITCH BOXES.—Machen & Mayer Electrical Manufacturing Company, Seventeenth and Vine Streets, Philadelphia, Pa.

"M. & M." single and sectional gang, pressed steel switch boxes for use with rigid conduit or flexible tubing.

Type A, Catalog Nos. 2045-2060 inclusive.

Motorless Sign Flasher, The Eclipse Electrical Manufacturing Company

Type P, Catalog Nos. 6001-6011 inclusive.

Approved January 10, 1912.

SWITCHES, PENDANT SNAP.—The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

For description and catalogue numbers see supplementary card.

Pendant snap switches shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories have label attached to device.

Approved January 5, 1912.

SWITCHES, PENDANT SNAP.—The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

The following switches are approved and labeled under conditions stated on card dated January 5, 1912.

(Two-button Type.)

Single-pole, 3 amperes, 250 volts, 6 amperes, Catalog No. 2532.

Approved January 6, 1912.

SWITCHES, SURFACE SNAP.—The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn.

(With Metal Covers.)

Three-pole, 15 amperes, 250 volts, Catalog Nos. 2025, 2046 (Vulcabeston Commutator.)

Three-way, 1 ampere, 250 volts, 3 amperes, 125 volts, Catalog Nos. 2455, 2456.

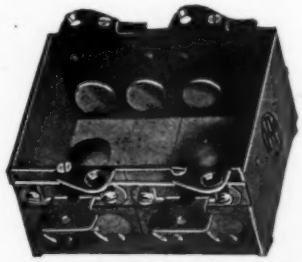
Three-way, 3 amperes, 250 volts, 5 amperes, 125 volts, Catalog Nos. 2027, 2175, 2321, 2322.

Three-way, 5 amperes, 250 volts 10, amperes, 125 volts, Catalog Nos. 2030, 2031, 2176, 2177.

Four-way, 2 amperes, 250 volts, 5 amperes, 125 volts, Catalog Nos. 2033, 2183.

Two-circuit, 2 amperes, 250 volts, 5 amperes, 125 volts, Catalog Nos. 2074, 2188, 2215, 2216, 2486, 2487.

Three-circuit, 2 amperes, 250 volts, 5 amperes 15 volts, Catalog Nos. 2070, 2072, 2185, 2187.



Switch Box, Machen & Mayer Electrical Manufacturing Company.

Three-Circuit, 1 ampere, 250 volts, 3 amperes, 125 volts, Catalog No. 2463.

Three-speed Fan-motor Switch, 5 amperes 125 volts, Catalog Nos. 2070, volts, Catalog No. 2385.

Also above types with lock attachment.

Approved January 26, 1912.

TUBING, FLEXIBLE.—The Flexible Conduit Company, Guelph, Canada.

Marking: Strings looped at intervals around turns of buff-colored fibre lining.

Standard labels. Flexible tubing shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, has label attached to tubing. This manufacturer is equipped to supply this tubing so labeled.

Approved January 9, 1912.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

STONEWALL, OKLA.—J. A. Cowling and others have been granted an electric light franchise.

FREEMAN, S. D.—Mathias Hafner and others propose to establish an electric light plant here.

FAIRFIELD, IOWA.—The Commercial Club contemplates installing an electrolier system this year. C.

MANCHESTER, LA.—The Mansfield Ice & Light Company contemplates remodeling its plant.

FREEMAN, S. D.—The town of Freeman is contemplating the installation of an electric light system.

TOMPKINSVILLE, KY. — Local capitalists are considering the installation of an electric light system.

CORYDON, IOWA.—The council voted to advertise for bids for an extension to the light plant. C.

PANCO, WASH.—The Pacific Power & Light Company will erect a transforming plant here to cost in the neighborhood of $200,000. C.

CENTRAL CITY, IOWA.—F. J. Cross will extend his system to Walker, and furnish light and power at that place. C.

GLENWOOD, MINN.—The Glenwood Mill & Electric Company contemplates installing an electric light plant here.

MYERSVILLE, IND.—The mayor is at the head of a project to construct electric light and water works plants at this place.

NISLAND, S. D.—The town of Nisland is preparing to install a light, heat and power plant and a city waterworks system.

DEVILS LAKE, N. D.—The council contemplates installing a "White Way" covering ten of the principal business blocks. C.

SILER, N. C.—The City Commissioners have granted a franchise to J. Wade Siler and W. D. Siler to install an electric light system.

KIMBALL, IOWA.—The village trustees have granted an electric light franchise to E. M. Miller, Greeley, Colo., for a 75-horsepower plant.

EUREKA, CAL.—Mayor F. W. Georgeson recommends to Eureka a municipal light, power and water plant, costing possibly as much as $1,000,000.

VIRGINIA, MINN.—It is rumored that the Great Northern Power Company, Thomson, Minn., will construct a transmission line from Thomson to Virginia. C.

KEARNEY, NEB.—It has been decided that Kearney will have a municipal lighting plant and bonds to the amount of $40,000 will be issued for the purpose.

ST. MARYS, O.—The Western Railway Company is planning to spend $100,000 on enlarging its power plant in this city this spring. New generators will be installed.

JOLIET, ILL.—The Chicago, Ottawa & Peoria Electric Railway Company will build an auxiliary steam power plant of 2,000-kilowatt capacity at an outlay of about $60,000.

FAIRVIEW, S. D.—Business men of this city and Canton have organized the Sioux Valley Power Company, for the purpose of developing electric power from the Big Sioux River. C.

RENO, NEV.—P. H. Patriarche has interested San Francisco capital and expects soon to commence the erection of a power plant on the Truckee River near Laughton Springs.

NEW YORK, N. Y.—The directors of the Federal Light & Traction Company have authorized an issue of $50,000,000 five-per-cent bonds and will make extensive improvements.

MENASHA, WIS.—A special electric street-lighting system is being planned for a distance of about two miles in Menasha. The business men of the city will finance the project.

BANGOR, PA.—The Industrial Electric Company of Bangor will shortly ask for a charter for the purpose of supplying electric light, heat and power to the citizens of Bangor.

BURLINGTON, IOWA.—The Burlington Power Company has filed articles of incorporation with a capital stock of $200,000. The incorporators include Charles E. Perkins, William Carson and E. P. Eastman.

BUSHNELL, ILL.—L. J. Highlond, Chicago; Mack H. Pinckley, Bushnell, and H. A. Kaiser, Good Hope, are behind a company which has plans well formulated for a new electric light and power station to be located at Bushnell.

GILBERT, MINN.—The Northern Minnesota Power Company has been formed to install an electric power plant to serve Aurora, Biwabik, McKinley and Gilbert. D. A. Reed, Duluth, is manager and consulting engineer of the project. C.

PETERSBURG, IND.—The City Council has directed the City Clerk to advertise for proposals for lighting the streets, city building, public places and for commercial purposes. R. M. Case, of Indianapolis, is consulting engineer for the city. S.

COLUMBIA, TENN.—An engineer of the Great Falls Power Company has been surveying a route over which to bring the power to this city and Mt. Pleasant, when the power plant now being constructed at Great Falls is completed.

TERRE HAUTE, IND.—A committee has been appointed by the Retail Merchants' Association to decide upon a type and install a cluster-light system in Terre Haute. The committee is composed of O. C. Hornung, C. T. Nehf, W. G. Valentine, Adolph Joseph and A. S. Cook. S.

FT. BRANCH, IND.—The Ft. Branch Light, Heat, Power & Water Company has been incorporated with a capitalization of $25,000. The object of this company is to build and install an electric light, power and water system in the village of Ft. Branch. W. L. Walters, S. R. Lockwood and J. E. Toop are the directors. S.

OWENSVILLE, IND.—Articles of incorporation have been filed by the Owensville Water, Light, Power & Heat Company for the purpose of building a joint plant for the furnishing of water, electric light, power and heat to the people of Owensville. The capital stock is $25,000. G. B. Beresford, George R. Welbourn, C. B. Smith, J. F. Cale and George A. Hanop are directors. S.

FALMOUTH, KY.—Mayor N. C. Ridgeway has announced that the municipal power plant is to be improved at once, and until March 11 proposals will be received for furnishing and installing a 35 or 50 kilovolt-ampere engine and generator, switchboard, transformers, series street lamps, etc., in accordance with plans and specifications which have been prepared by Engineers Anderson & Frankel, Lexington.

HENDERSON, KY.—The Electric Light Committee has asked for an appropriation of $25,000 to be expended in improving the municipal power plant and lighting system. A 900-horsepower Westinghouse turbine, similar to that now in use in the plant, is to be purchased for use in handling unusually heavy loads which are forced upon the present equipment. The magnetite system of street lighting is also to be installed.

LLANO, TEX.—N. J. Badu and associates, who are extensively interested in iron-ore deposits in this section, are preparing to install a hydroelectric plant for the purpose of generating electricity with which to smelt the ores. It is planned to erect a large dam across the Colorado River at a point about 12 miles from here to form a storage reservoir which will give a water supply for generating the necessary electric power. D.

TAMPICO, MEX. — Authoritative announcement is made here that S. Pearson and Son, Limited, the British syndicate which owns the electric street railway and power plant at Vera Cruz, has purchased the three electric light plants and the street railway system here, and will soon effect the merging of the former competiting properties into one large plant. It will also transform the street railway system into one electric traction and make important extensions, one of which will run to La Barra, a surf bathing resort six miles below Tampico. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ROME, GA.—The Rome & Farill Telephone Company has been incorporated by John Paul Farill and others.

BLOOMER, WIS.—O. A. Spencer and D. T. Haskins will remodel the telephone system recently purchased.

BERTHA, MINN.—The telephone company will build a modern brick telephone exchange here this spring.

SPOKANE, WASH.—The Farmers' Inland Co-operative Telephone Company has been granted a 20-year franchise.

BOISE, IDAHO.—An ordinance has been passed compelling telephone wires to be placed underground by January 1, 1913.

WADENA, MINN.—Farmers southwest of town are forming a new telephone company and will build a line early in the spring. J. J. Miller is president. C.

ARCADIA, WIS. —The Western Wisconsin Telephone Company will build a new telephone exchange here this spring, and make other improvements. C.

CAMBRIDGE, MINN.—The Stanley Rural Telephone Company has been organized to build a line from here to Spring Lake. E. R. Anderson is president. C.

BROOKSVILLE, FLA.—The Florida Telephone Company will make extensive improvements to its telephone system, including cable, main lines, new poles and crossarms.

RIVERSIDE, CAL.—The Interstate Telegraph Company has filed articles of incorporation with $100,000 capital stock. The directors are P. E. Ellis, James Smythe and William Miller.

HARTFORD, KY.—The Hartford Telephone Company has been incorporated with a capital stock of $10,000 by William W. Crawford, W. T. Hale and J. Joseph Hettinger, all of Louisville, Ky.

WOLFORD, N. D.—The Union Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are J. T. Hawk, George Baker, Harry B. Flint, Peter Peck and D. L. Peters.

HIGHLAND, WIS.—The Red Oak Telephone Company has been incorporated with a capital stock of $242. The incorporators are H. B. Pierick, William Manning, Herman Efinger and Frank Hudek.

CULLMAN, ALA.—At a recent meeting of the Cullman Commercial Club a committee was appointed to draw up plans and make recommendations to the people relative to the installation of a new telephone system.

WEAVERVILLE, CAL.—Benjamin Barnicle has acquired the properties of the Weaverville telephone system and its connections from the Pacific States Telephone & Telegraph Company. It is understood that improvements will be made in the system.

RED BLUFF, CAL.—The Independent Telephone Company is going to build extensions to all parts of Tehama County, and to have long distance phone connection from Redding to Sacramento and San Francisco in a short time.

SEATTLE, WASH.—The Mutual Telephone Company has been organized by W. D. Torrey, Audley Gegg and Charles Williams, who have a franchise to construct a line to the mouth of the Elk Creek River, a distance of nine miles.

TENSTRIKE, MINN.—E. E. Skulke is president and H. Stechman is secretary of a new telephone company organized here to build a line about nine miles in length on the north side of Gull Lake. Work will be commenced as soon as the ground is in suitable condition.

LONGVIEW, TEX.—The City Council has granted a new franchise to the Lacy Telephone Company on the terms that all telephone wires on the business streets must be placed underground. The telephone company also agrees to install within one year a central-energy system.

CHESTER, S. C.—The stockholders of the Chester Telephone Company have authorized the directors to overhaul the local telephone plant and install the common-battery or central-energy system. This will entail an expenditure of about $5,400, and work will be commenced as soon as weather permits.

NORTON, IND.—The Norton, Luke & French Lick Telephone Company has incorporated for the purpose of constructing and operating a telephone system in Norton, and throughout Dubois County. The capital stock is $4,000. The incorporators are: Oscar Cox, W. R. Cox, H. F. Simmons and Harry C. Cox. S.

GRAND RAPIDS, MICH.—District Commercial Manager G. R. Heywood, of the Michigan State Telephone Company, has received orders from Commercial Superintendent C. E. Wilde, of Detroit, of the approval of estimates for improvements in the Grand Rapids district amounting to nearly $12,000. These improvements include a new power plant at Kalamazoo, new equipment in Albion and Ludington and change in certain toll routes.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ST. PAUL, MINN.—The Rotary Club is interested in a project to build an electric railway from St. Paul to tributary country.

SAULT SAINTE MARIE, MICH.—It is rumored that the Escanaba Lumber Company will build an electric railroad between DeTour and Rudyard.

ELLISVILLE, MISS.—The Laurel Railway, Light & Power Company has been granted a franchise to build an electric line to the Agricultural High School.

LYNVILLE, IND.—A franchise has been granted to the Evansville, Chrisney & Eastern Traction Company. A preliminary survey for the proposed road will be made very soon.

BELLVILLE, TEX.—The business men of this place have decided to build an interurban road between here and LaGrange. The road will run through Industry and Nelsonville.

BURLINGAME, CAL.—Work will shortly be commenced on a new electric line starting at Easton Station and running through the lands of the Easton estate on to Spring Valley Lake district.

BOLIVAR, N. Y.—Wellsville capitalists are talking of building a line from Bolivar, *via* Acio and Allentown, a distance of about 20 miles. It is estimated that the line will cost about $250,000.

MIDDLEFIELD, CONN.—It has been decided to build a trolley line from Middlefield to Durham this spring. Former Senator Atwater, of Meriden, and Representative Arrigoni, Durham, are interested in this project.

TERRE HAUTE, IND.—An interurban railroad to connect Terre Haute with St. Louis, a distance of 145 miles, is being pomoted. A number of contracts for right of way are said to have been secured and terminal arrangements made. S.

GLENDALE, CAL.—The City Trustees have granted a 44-year franchise to E. D. Goode for an electric line from Fourth Street and Brand Boulevard west to Pacific Avenue to Vine Street and from there to the western city limits.

SANTA BARBARA, CAL.—The Chamber of Commerce and the Commercial Club have unanimously approved the proposition of the owners of the present street railway here for a 45-year franchise upon the promise that the company would expend $250,000 in reconstructing its line.

OAKLAND, CAL.—It is announced that the Oakland & Antioch Railway Company will build an electric line between Bay Point and Lafayette to the base of Mt. Diablo, where it will connect with the scenic route, which has long been in contemplation, and which is being encouraged by the civic organization of this city.

FAIRMONT, W. VA.—The West Penn Railway Company is behind a project to connect Pittsburgh and Fairmont, with a host of other towns, to Wheeling with a trolley line. The plans as announced call for contracts to be let at once to extend the line further from Point Marion to Waynesburg, to Connellsville and Uniontown, and to connect them with Washington, Pa.

BARRANQUILLA, COLOMBIA.—At Barranquilla, Colombia, a syndicate headed by Enrique Correa, Enduardo Martinez, and Arturo Arcardi has purchased the street-railway system and will immediately proceed to install electric traction in place of horses. The present system comprises five miles and is to be extended. Electric-railway manufacturers should communicate directly with the gentlemen named, preferably in Spanish.

NEW INCORPORATIONS.

LITTLE ROCK, ARK.—The Guthrie-Mitchell Company has been incorporated with a capital stock of $200,000. The company will manufacture electrical supplies.

MILWAUKEE, WIS.—The Parker Electric Company has been incorporated with a capital stock of $10,000. The incorporators are George A. Parker, William Graf and Paul E. Neuman.

KANSAS CITY, MO.—The Baker Electric Company has been incorporated with a capital stock of $5,000. A. J. Pray, R. C. Norton, J. D. Norton, Jr., E. S. Jackson and O. C. Snider are the incorporators.

BROOKLYN, N. Y.—John L. Kruger Electrical Construction Company has been incorporated with a capital stock of $5,000. John L. Kruger, Fran-

cis Hammill and Mary Kruger, all of Brooklyn, are the incorporators.

NEW YORK, N. Y.—The William Roche Electrical Company has been incorporated with a capital stock of $10,000. The incorporators are William Roche, Jersey City, N. J.; Marcus G. Goldstein, Brooklyn, N. Y., and Louis Feitelson, New York City.

NEW YORK, N. Y.—The firm of James B. Cullen, Incorporated, has been incorporated with a capital stock of $1,000 to engage in the manufacture of electric devices. The incorporators are James B. Cullen, Mary E. Cullen and Elizabeth Cullen, New York City.

CLEVELAND, O.—The R. C. Hull Electric Company has been incorporated with a capital stock of $10,000 to deal in electrical appliances and supplies. James H. Cassidy, Mark A. Copeland, W. S. Mitchell, Joseph A. Schultz and G. B. Kennerdell are the incorporators.

NEW YORK, N. Y.—Blauvelt & West Company has been incorporated with a capital stock of $75,000 to engage in electrical engineering, the manufacture of tools, etc. William E. Blauvelt and Edward West, Brooklyn, and Ernest F. Schmidt, New York City, are the incorporators.

GENEVA, N. Y.—Central New York Engineering & Equipment Company has been incorporated with a capital stock of $10,000 to engage in an electrical engineering and contracting business. The incorporators are John H. Sharpe, Geneva; Fred Bowers, Penn Yan, and Margaret H. Bowers, Penn Yan.

BUFFALO, N. Y.—Electrical Park Amusement Company has been incorporated with a capital stock of $6,000 for the purpose of operating an amusement park, using electricity for lighting purposes, power, etc. Harry G. Johnson and Edwin G. Sutton, Buffalo, and Louis H. Sutton, Akron, are the incorporators.

EDINBURG, IND.—The Inter-State Electric Company, capitalized at $50,000, has filed articles of incorporation. The object of the company is to manufacture electricity and contract for light, heat and power, and also the sale and installation of electrical supplies in the town of Edinburg. C. J. Huff, George M. Hornecker, William McConnell and Frank Cellen are the incorporators. S.

INDIANAPOLIS, IND.—The Electro Light & Starter Company has filed articles of incorporation with the declared purpose of engaging in the manufacture of electricity for light, power and other purposes to be used in connection with the lighting, starting and operation of automobiles, etc. The principal place of business will be in Indianapolis. Frank H. Wheeler, Joseph E. Bell, Charles C. Wedding and Harry J. Spann are the incorporators. S.

NEW PUBLICATIONS.

SOCIETY FOR TESTING MATERIALS.—Vol. XI of the *Proceedings of the American Society For Testing Materials* has come from the press. It contains the proceedings of the fourteenth annual meeting held at Atlantic City, N. J., in June, 1911. The standard specifications and committee reports on hard-drawn copper wire, on magnetic tests of iron and steel, and on coal will be found of especial interest.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.)

No. 8111. ELECTRIC LIGHT AND POWER PLANT.—A report from an American consular officer in a Latin-American country states that an electric light and power plant is to be established to supply light for several towns in his district. American manufacturers and exporters of electric-light fixtures should communicate direct with the person who will have charge of the purchasing of supplies for this undertaking.

No. 8113. TELEPHONE APPARATUS AND EQUIPMENT.—An American consul in a Latin-American country reports that negotiatons are being conducted with regard to a concession for the establishment of a telephone system in a city of his district. Copy of the complete report, giving further details and the name of the concessionaire, can be secured from the bureau of manufactures.

No. 8119. ELECTRIC SUPPLIES OF VARIOUS KINDS.—An American consular officer in a European country reports that a firm in his district wishes to communicate with manufacturers of dynamos, industrial machines, electric elevators, apparatus for electric lighting installations, etc. The firm furnishes bank references and corresponds in English.

No. 8122. ELECTRICAL APPARATUS.—An American consular officer reports that a firm in Latin America has in hand a transaction in electrical apparatus and has requested to be placed in communication with an American house in a position to obtain supplies of various kinds for competent American manufacturers. The firm in question has been organized recently, and in a circular announcing its formation the statement is made that it is in relations with prominent banking concerns.

NO. 8209. MACHINERY FOR ELECTRIC LIGHT PLANT.—A report from an American Consul states that bids will shortly be asked for considerable machinery for an electric light plant amounting to $100,000 to $200,000.

NO. 8211. ELECTRICAL SUPPLIES.—A firm dealing in electrical supplies, wire, and insulators in the United Kingdom has applied to an American consular officer for the names of American manufacturers of electrical supplies, galvanized-iron wire, wire nails, and copper wire, in order to secure agencies for these articles. The firm is an old established one and willing to supply any references that may be required.

PROPOSALS.

ELECTRICAL SUPPLIES.—Proposals will be received until March 12 by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., for 10 motors to be delivered at Brooklyn, N. Y.

PROPELLING MACHINERY.—Sealed proposals for furnishing propelling machinery and electric installation for repair of United States inspection boat *Gannet* will be received by the United States Engineer, Wilmington, Del., until March 18. Information may be received from R. R. Raymond, major, engineers.

ELECTRICAL MACHINERY.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 8 for motors, pump motor starters, etc., for the canal locks and spillways, as per Canal Circular 681. Blanks and general information relating to this circular may be obtained from the office of the general purchasing officer or from the assistant purchasing agents in any of the large cities.

FINANCIAL NOTES.

Speculative interest in the stock market for the past week has been duller even than that which was reported for the last four or five weeks. Not even the introduction of Mr. Roosevelt into the political arena has shaken the apathy, and it is a question now as to what means must be looked for to bring about even a semblance of decision with regard to a forward movement.

Notwithstanding the spiritless condition of the market with regard to speculation, industry as a whole apparently is in better condition. A gratifying commentary on this situation is the report of the Commonwealth Edison Company of Chicago, for the fifteen months ended December 31, 1911. These were the largest since the organization of the company. Earnings figure 9.75 of the $3,964,800 capital actually issued. This was outstanding for twelve months out of the fifteen.

It is announced that the Gary rail mill of the United States Steel Corporation, idle since September, was placed in operation on February 26. A 30,000 order of 80-pound steel rails is being rolled for the State Railways of New South Wales. Later, large orders for shipments to Canadian ports will be filled. The South Chicago Bessemer rail mill began rolling rails on Tuesday after having been idle for several weeks.

At the annual meeting of the stockholders of the Mountain States Telephone and Telegraph Company, held at Denver, Colo., on February 13, the directorate was made up as follows: E. B. Field, E. B. Field, Jr., Philip Hamlin, Crawford Hill, A. V. Hunter, E. S. Kassler and Lawrence C. Phipps, Jr., of Denver; Theo. N. Vail and U. N. Bethell of New York; W. L. Graham, of Pueblo, and W. S. McCormick of Salt Lake City.

The $7,500,000 Puget Sound Traction, Light & Power two-year five per cent mortgage notes offered by N. W. Harris & Company and Lee, Higginson & Company, of Boston, have all been sold on a 4.75 per cent income basis.

At the annual meeting of Electric Bond & Share Company, Alexander J. Hemphill, president of the Guarantee Trust Company and E. W. Hill, treasurer of the company, were elected directors, to succeed George B. Moffat and Alden M. Young, both deceased.,

At the annual meeting of the stockholders of the American District Telegraph Company of New York, Ford Huntington was elected a director to succeed J. S. Patterson, who resigned.

The Third Avenue Railway has made application to the Stock Exchange to list

$15,790,000 interim certificates for first refunding mortgage four per cent bonds, $22,536,000 interim certificates for adjustment mortgage income five per cent bonds, and $16,590,000 capital stock.

William V. Hester, of Brooklyn, has been elected a director of the Kings County Electric Light & Power Company and of its operating company, the Edison Electric Illuminating Company, to succeed the late A. M. Young, who was a director and first vice-president of both companies.

Henry L. Doherty & Company, New York, offers for public subscription $750,000 of Ozark Power & Water Company common stock and $1,500,000 Electric Bond Deposit Company six-per-cent cumulative guaranteed preferred stock, at $1,000 for $500 par value of Ozark Power & Water Company common stock and $1,000, par value, of Electric Bond Deposit Company six-per-cent preferred stock. Subscriptions are to be received for the new stocks until March 1. The success which attended the public subscription to the Cities Service preferred and common stocks offered in November, 1910, by this firm, and the advance which has taken place in both these stocks since that time, make certain that the present offering from this reliable house will be quickly taken by investors.

Dividends.

El Paso Electric Company; a semi-annual dividend of $3 a share on its common stock, payable March 15 to holders of record March 4. This is an increase of one-half of one per cent over last previous payment of 2.5 per cent on September 15.

Mackay Companies; quarterly common dividend of 1.25 per cent, and preferred of one per cent, both payable April 1 to stock of record March 9.

Mahoning & Shenango Valley Railway & Light Company; a dividend of 1.25 per cent.

Reports of Earnings.

SHAWINIGAN WATER & POWER.

The Shawinigan Water & Power Company has issued its pamphlet report for the year ended December 31, 1911. The income account compares as follows:

	1911	1910
Gross	$1,349,715	$991,029
Expenses	160,452	127,386
Net	1,189,263	863,643
Interest	436,750	456,387
Balance	*752,513	407,255
Dividends	456,250	286,378
Surplus	296,263	120,877
Reserve fund	249,637	85,000
Surplus	46,626	35,877
Previous surplus	23,146	2,876
Total	69,772	38,753
Construction and depreciation	60,000	15,607
Profit and Loss surplus	9,772	23,146

*Equal to 7.52 per cent on $10,000,000 capital stock. This compares with 4.8 per cent earned on $8,500,000 stock previous year.

WINNIPEG ELECTRIC RAILWAY.

The Winnipeg Electric Railway Company has issued its report for the year ended December 31, 1911, which compares as follows:

	1911	1910
Gross revenue	$3,829,749	$3,284,342
Operating expenses	1,900,968	1,654,834
Net revenue	1,928,782	1,629,508
Fixed charges	818,208	694,739
Balance	*1,110,574	934,769
Dividends	690,000	600,000
Surplus for year	420,574	334,769
Previous surplus	1,196,199	861,430
Total surplus	1,616,773	1,196,199

*Equal to 18.50 per cent earned on $6,000,000 capital stock, as compared with 15.58 per cent earned on same stock previous year.

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction & Light Company, for the month of January, compares as follows:

	1912	1911
January gross	$209,389	$186,271
Expenses	122,536	106,904
January net	86,853	79,367
Charges	43,824	44,429
Surplus	43,029	34,938

LONDON UNDERGROUND.

The Underground Electric Railways Company of London, Limited, reports for the six months ended December 31, 1911, compared as follows:

	1911	1910
Income from inv., op. of power house, etc.	£156,549	£146,019
Gen'l expenses, salaries,	102,533	119,590
Balance	54,015	26,429
Interest payable on income bonds, plus tax	52,333	26,167
Surplus	1,682	262

WASHINGTON WATER POWER COMPANY.

The Washington Water Power Company has issued its annual report for the year ended December 31, 1911. The income account compares as follows:

	1911	1910
Gross	$3,264,158	$3,155,223
Expenses and taxes	1,652,981	1,678,540
Net	1,611,177	1,476,683
Charges, depreciation, etc.	637,495	557,910
Surplus	*973,682	918,773
Dividends	939,008	708,231
Surplus	34,674	210,542
Previous surplus	1,071,041	860,499
Total surplus	1,105,715	1,071,041
Adjustment, credit	80,325	.....
Profit and loss surplus	1,186,041	1,071,041

*Equal to 8.3 per cent on $11,737,600 capital stock, as compared with 9.78 per cent earned on $9,390,100 stock previous year.

TOLEDO RAILWAYS & LIGHT COMPANY.

The Toledo Railways & Light Company has issued its pamphlet report for the year ended Dec. 31, 1911. The income account compares as follows:

	1911	1910
Gross	$3,399,372	$2,985,232
Expenses and taxes	2,384,838	1,868,450
Net	1,014,534	1,116,782
Charges	820,424	926,381
Surplus	194,110	190,401

In regard to franchise the report states: "Negotiations between the city authorities and the company relative to obtaining a new franchise have taken place from time to time. Under a temporary arrangement the company is now offering a five-cent cash fare or sells tickets at the rate of six for 25 cents, with universal transfers, and between the hours of 5:30 and 7:30 in the morning and 4:30 and 6:30 in the evening passengers are carried for 3 cents and given transfers. Children under eight years of age are carried for one cent during all hours of the day. It is quite probable that no permanent contract will be made with the city until after a 90-day trial of the above rates of fare has been made, in order to ascertain the effect of such rates of fare."

KINGS COUNTY ELECTRIC LIGHT & POWER.

The Kings County Electric Light & Power Company reports as follows for January, 1912:

	1912	Increase
Gross operating revenue	$498,977	$56,554
Operating expenses, taxes, etc.	280,692	27,586
Net operating revenues	218,285	28,968
Other income	4,812	*472
Total income	223,097	28,496
Bond discount written off	1,689	.....
Balance	221,408	28,496
Fixed charges	70,547	7,500
P. & L. surp. for month	150,861	20,996

*Decrease.

SYRACUSE RAPID TRANSIT.

The report of Syracuse Rapid Transit Company to the up-state New York Public Service Commission, for the quarter ended December 31, 1911, compares as follows:

	1911	1910
Total street railway operating revenue	$416,858	$400,036
Total operating expenses	258,371	266,749
Net operating revenue	158,487	133,287
Taxes accrued	17,675	17,505
Operating income	140,812	*115,782
Surplus after charges	85,654	37,162

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of January and seven months ended January 31, 1912, compares as follows:

	1912	1911
January gross	$ 125,716	$ 121,196
Expenses	81,615	89,492
January net	44,102	31,704
Charges and taxes	36,934	35,018
January surplus	7,167	*3,314
Seven months gross	1,108,662	1,055,652
Expenses	609,838	593,326
Seven months net	498,824	462,326
Charges and taxes	256,468	236,911
Seven months surplus	242,355	225,414

*Deficit.

NATIONAL CARBON COMPANY.

The National Carbon Company reports for the fiscal year ended December 31 last as follows in comparison with the previous year:

	1911	Decrease
Net income	$931,145	$372,151
Preferred dividends	315,000	.....
Balance	616,145	372,151
Common dividends	330,000	.....
Balance	286,145	372,151
Depreciation	234,820	45,180
Custom's' accts. writ'n out	7,154	*1,261
Total deductions	241,974	43,919
Surplus	44,171	328,232
Previous surplus	472,729	452,597
Total surplus	516,900	780,829
Extra dividend 15 per cent	.....	825,000
Final surplus	516,900	*44,171

*Increase.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 26.	Feb. 19.
Allis-Chalmers common (New York)	⅞	¾
Allis-Chalmers preferred (New York)	5½	5½
American Tel. & Tel. (New York)	142	141
General Electric (New York)	160½	157½
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	82⅞	82¼
Postal Telegraph and Cables preferred (New York)	70	69½
Western Union (New York)	84⅞	83¾
Westinghouse common (New York)	73¼	70½
Westinghouse preferred (New York)	*114	*114
Edison Electric Illuminating (Boston)	294	298
Massachusetts Electric common (Boston)	20½	20
Massachusetts Electric preferred (Boston)	94	93½
New England Telephone (Boston)	160	159½
Electric Company of America (Philadelphia)	11¾	11⅞
Electric Storage Battery common (Philadelphia)	53¾	54¾
Electric Storage Battery preferred (Philadelphia)	53¾	54¾
Philadelphia Electric (Philadelphia)	18⅛	18½
Chicago Telephone (Chicago)	139½	139
Commonwealth Edison (Chicago)	142	139½
National Carbon common (Chicago)	100	100
National Carbon preferred (Chicago)	115	116

*Last price quoted.

PERSONAL MENTION.

RUSSELL B. CRESS, formerly with the Arrow Electric Company, Hartford, Conn., has been appointed eastern sales manager of the Opalux Company, with offices at 258 Broadway, New York.

JOHN M. KLEIN, manager of Mathias Klein & Sons, Chicago, Ill., left last week on his annual trip to the Pacific coast. In addition to calling on the trade, Mr. Klein takes advantage of his annual trip to obtain a much needed rest.

MATTHEW B. CARSON has opened offices in the Singer Building, New York, where he is engaged in illuminating engineering and will represent as manufacturer's agent the M. & M. Electric Company and the Fostoria Incandescent Lamp Company.

MATTHEW C. BRUSH, assistant to the vice-president of the Boston Elevated Railway Company, has been appointed second vice-president, to take effect March 1, 1912. Mr. Brush is well known throughout the street-railway field as an executive officer, and has made an enviable reputation for himself in the department of public relations.

BERTRAM M. DOWNS, vice-president and director of the Brookfield Glass Company, of New York, resigned from that company last week, and will take a well deserved vacation before entering upon new duties. Mr. Downs had been connected with the Brookfield Company for 26 years, and possesses a very wide and popular acquaintance in the electrical field.

THOMAS A. EDISON celebrated his sixty-fifth birthday, which occurred on Sunday, February 11, on Saturday evening, February 10, at his home at Glenmont, Llewellyn Park, N. J. One hundred of his earliest and closest associates who had been identified with him for the last thirty or thirty-five years spent the evening with him at his invitation. Among those present were Edward H. Johnson, Samuel Insull, William J. Hammer, John W. Howell, John W. Lieb, Jr., T. C. Martin and Robert T. Lozier, who presided.

H. M. SWETLAND has been elected chairman of the Board of Directors of Wyckoff, Church & Partridge, New York, N. Y., the pioneer automobile concern. Mr. Swetland was formerly head of the Class Journal Company and is at present a director in the United Publishers Corporation. Mr. Swetland brings with him the ripe experience of his close connection with the automobile industry from its inception as publisher of the leading technical and class papers covering the broad field of everything pertaining to motor-car promotion and distribution.

ALEXANDER CAMERON, counsel for the New York Telephone Company, was married on February 20 to Mrs. Agnes Burke Nicholson, at the Church of the Ascension, New York City. Mr. Cameron gave up the practice of law in 1881 to become president and counsel of the Long Island Telephone Company, which was afterward merged with the New York & New Jersey Telephone Company. This company he served variously as president, vice-president, treasurer, counsel, and director. When the company was merged with the New York Telephone Company he became counsel for the New York Telephone Company, which position he now holds.

FRANCIS A. VAUGHN, of the firm of Vaughn & Meyer, consulting engineers, Milwaukee, Wis., presented a paper entitled "Relations of Modern Electric Meter Practice to Consumer, State Commissions and Central Stations" before the annual meeting of the Engineering Society of Wisconsin at Madison, Wis., on February 16. Mr. Vaughn is secretary of the Meter Committee of the National Electric Light Association and editor of the "Electrical Meterman's Handbook," which is now in preparation. In the paper referred to he shows that increased accuracy, more complete and systematic routine, more stringent requirements by the various state commissions and by the consumer, together with cheaper, simpler, smaller and more convenient types of instruments exemplify the present practice respecting consumers watt-hour meters.

OBITUARY.

MRS. WILLIAM G. McADOO, wife of the president of the Hudson & Manhattan Railway Company, died February 22 at her home, Irvington-on-Hudson, from heart disease. Mrs. McAdoo had been an invalid for the last eight years.

GEORGE E. GOURAUD died recently at Vevey, Switzerland, at the age of 70. He was a colonel in the Civil War and was associated with Thomas A. Edison in the sale of electrical inventions. He had lived in Europe for the last 20 years.

AUGUSTUS G. DAVIS, a pioneer telephone and electric-railway man, died recently at Elkridge, Md. Mr. Davis was born in Waterford, N. Y., in 1834, going to Baltimore in 1870. He was for a number of years in control of the Viaduct Electric Company, of Relay, Md.

F. H. STRIEBY, of the Cincinnati office of the General Electric Company, died Sunday, February 18, after an illness of only a few days. Mr. Strieby was one of the pioneers in electric work, having installed many of the early street-railway systems in this country.

HENRY TAYLOR BOVEY died at Eastbourne, England, on February 2. He was appointed professor of civil engineering and applied mechanics at McGill University, Montreal, in 1877, and in 1878 was made dean of the new department of applied science. In 1908 he was appointed rector of the Imperial College of Science and Technology in London, England.

SAMUEL MORRIS DODD died at St. Louis, Mo., February 13. He was president of the Wagner Electric Manufacturing Company for 19 years, and was recently chosen chairman of the Board of Directors. He organized and for many years headed the Missouri Edison Electric Company, retiring from the management when that company was sold to the North American Company. He was interested in many financial concerns in St. Louis. He was succeeded as president of the Wagner Company by W. H. Layman. Mr. Dodd was 79 years old.

JOHN BURKITT WEBB, consulting engineer, and until five years ago professor of mathematics and mechanics at the Stevens Institute of Technology, died in Hoboken, N. J., on February 18, at the age of seventy-one years. Professor Webb was the inventor of numerous devices used in the measurement of power. He was graduated from the University of Michigan in 1871, and studied at the universities at Berlin, Heidelberg and Paris. He was later professor of civil engineering at the University of Illinois and of applied mathematics at Cornell.

FRANCIS H. STILLMAN, president of the Watson-Stillman Company, and a prominent figure in machine-tool and engineering industries, died suddenly February 18 of intestinal hemorrhage at his late residence in Brooklyn, N. Y., in his sixty-second year. The day before his death he was at his office as usual and apparently in the best of health.

Mr. Stillman was born in New York City on February 20, 1850, and was graduated from Yale in the class of 1874. He was a member of the Engineers' Club, the American Society of Mechanical Engineers and treasurer and a director of the National Association of Manufacturers. He organized and was first president of the Machinery Club of New York, and was also first president of the National Metal Trades Association.

DATES AHEAD.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., March 21-22.

Northwestern Electric Show. Minneapolis, Minn., March 16-23.

National Railway Appliances Association, Inc., Chicago, Ill., March 18-23.

American Railway Engineering and Maintenance of Way Association, Chicago, Ill., March 19-21.

Minnesota Electrical Association. Annual meeting, Minneapolis, Minn., March 20-22.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society. Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, Iowa, April 24-25.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Michigan Section of the National Electric Light Association. Annual convention, on board the *Majestic*, sailing from Port Huron, Mich., about June 21.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., June 17-20.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

With the Electrical Manufacturers

The Economy Electric Company, Warren, Ohio, has removed its sales offices to the Packard Block on North Park Avenue.

The Duplex Metals Company, Chester, Pa., is sending out a unique folder that shows the advantage of using copper-clad ground rods which eliminate rusting.

The Pettingell-Andrews Company, Boston, Mass., in its February number of *Juice*, calls attention to several of its specialties in an attractive manner. Among these are Sechrist fixtures, General Electric ozonators, Crouse-Hinds panel boards and Patterson battery sets for the convenient mounting of dry batteries.

W. N. Matthews & Brother, 3722 Forest Park Boulevard, St. Louis, Mo., has issued a pamphlet calling attention to four of their cable specialties that have proved highly economical to many users. These are their cable rollers, cable dips, cable-splicing joints and the Telafault test set for locating cable troubles.

The Adams-Bagnall Electric Company has moved its Philadelphia office to the Commonwealth Building at the corner of Chestnut and Twelfth Streets. The more commodious quarters thus secured are in charge of District Manager R. C. Campbell.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued folder No. 4202, illustrating and describing the new Westinghouse metallic flame arc for headlight service. Folder No. 4224 describes the type B-3 mine-suspension trolley-wire clamp and illustrates its application by showing complete and sectional views.

The M. W. Dunton Company, 65 Atlantic Avenue, Providence, R. I., is sending out reply post cards, by means of which anyone using narrow tape for armature or field winding or other purposes can send for sample cards of these tapes. The company will also send samples and prices on its friction and varnished tapes, sleevings, Nokorode soldering paste and other of its products.

The Federal Sign System (Electric), Home Insurance Building, Chicago, is sending out a unique folder devoted to Federal lock clamp bushings. Their merits are pointed out both pictorially and in rhyme. These bushings are made of a single piece of vitrified porcelain with a metal clamping ring. Seven sizes of the standard bushing are made and also several special long and elbow types.

The National Tube Company, Pittsburgh, Pa., is sending out to those interested in boiler plants copies of its *N. T. C. Bulletin*, which contains an abstract of a paper on the "Corrosion of Boiler Tubes," by Rear Admiral John D. Ford, of the United States Navy. This gives a summary of the results of an important research that is of particular value to all interested in the long life of boiler tubes.

The American Electric Company, State and Sixty-fourth Streets, Chicago, Ill., has issued Bulletin 40 devoted to its extensive line of magneto telephone switchboards, telephones, and exchange and substation accessories. These magneto boards embody a number of interesting features. The bulletin contains 80 large pages, thus giving some idea of the great variety of equipment the company has in stock.

Alfred F. Moore, 200 to 218 North Third Street, Philadelphia, Pa., manufacturer of insulated wire for all electrical purposes, has established three new sales agencies in southern cities as follows: Chattanooga, Tenn.; Louisville, Ky.; Birmingham, Ala. The two former branches carry stocks of magnet and weatherproof wires; the Birmingham office will have stocks of weatherproof, office, annunciator and rubber-covered wires and lamp cord.

The Kellogg Switchboard & Supply Company, Chicago, Ill., has issued a little pamphlet entitled "Fables in Telephones." These are highly entertaining and include some valuable morals relating to telephone signaling, rates and borrowing of telephone service. Copies of this little pamphlet, which is attractively illustrated, should be in the hands of every telephone company, as well as of the telephone-using public.

The Allis-Chalmers Company, Milwaukee, Wis., has been awarded the contract for the new generating and motor apparatus for the complete electrical equipment of the big plant of the German-American Sugar Company, Bay City, Mich. This is said to be one of the very few sugar factories to adopt exclusive electric drive and is the first in this part of the country. The generators are three-phase, sixty-cycle, and the total horsepower in motors will aggregate 700.

The Locke Insulator Manufacturing Company, Victor, N. Y., manufacturers of "Victor" high-potential insulators and specialties, has closed contracts for suspension-type transmission insulators as follows: New England Power Company, Massachusetts, 66,000 volts; Mexican Northern Power Company, Mexico, 110,000 volts; Southern California Edison Company, 66,000 volts; Puebla Tramway, Light and Power Company, Mexico, 110,000 volts; Cia Beneficiadora de Pozos, Mexico, 60,000 volts; Tri-City Railway and Light Company, Iowa, 33,000 volts.

The Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, has recently issued bulletin 19 illustrating and describing the electric luminous radiator, and calling attention to the many ways in which it may be made a convenience in the home. Comparisons are drawn between the luminous and the non-luminous types of radiator. A table of data on luminous-radiator lamps in regard to size, wattage, voltage, etc., is inserted.

The Tregoning Electric Manufacturing Company, Cleveland, Ohio, has issued its catalog and price list No. 4. This is devoted particularly to its many varieties of attachment plugs, rosettes and receptacles. The plugs are both of the separable and solid type. Rosettes are equipped with or without fuses. An interesting new device is a combination cleat and receptacle, which is made both for surface and suspension wiring. The receptacles that this firm handles are of many types and like the other specialties made, have become well known for their reliability.

The General Electric Company, Schenectady, N. Y., has published several new bulletins of interest. Bulletin No. 4900 is a 44-page catalog of apparatus for series incandescent street lighting, such as Mazda street series lamps, tungsten economy diffusers, lamp brackets of various styles, constant-current transformers, switchboard panels and lighting arresters. Bulletin No. 4918 describes direct-current panels for generator and feeder circuits and for general switchboard use in central stations and railway power houses. Bulletin No. 4887 is devoted to turbo-generator sets of 5 to 300 kilowatts in rating; these are all of the horizontal type and can be arranged to operate either condensing or non-condensing; this bulletin is excellently illustrated. Bulletin No. 4920 deals with type GE-203A railway motors; these are of the box-frame commutating-pole type rated at 50 horsepower on 600-volt lines and are considerably lighter for horsepower output than previous designs.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has published a booklet on the numerous private telephone systems that it manufactures. These are in general of two types, private-branch exchanges having a private operator, and the Inter-Comm-Phone system which is an interior telephone system particularly serviceable for large factories, offices, public and private institutions. These latter systems are entirely automatic in the sense that they do not need an operator and are made to provide for any number up to thirty-two instruments. The P. B. X. boards may be equipped with the code call and general alarm system which enables signals to be given to any or all departments of an institution, and also permits any officer to be called no matter in what department he may be. In connection with each of these two general classes of interior telephones the company manufactures a large variety of telephone instruments of the wall and desk types, and also of the combination type.

Record of Electrical Patents.

Issued by the United States Patent Office, February 20, 1912.

1,017,648. Vacuum Lightning-Arrester. F. S. Chapman and J. T. Greene, assignors to National Electric Specialty Co. Within a chamber are two opposite plate electrodes with projections and an insulated, perforated barrier between the electrodes.

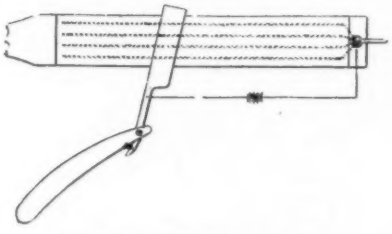
1,017,649. Lightning-Arrester. F. S. Chapman, assignor to National Electric Specialty Co. Relates to the manner of mounting the arrester vessel.

1,017,670. Voltage Regulator. R. P. Jackson, assignor to Westinghouse Electric & Manufacturing Co. An alternator field has in series with it a resistance and is fed from a mercury-arc rectifier connected through a transformer across one phase of the alternator leads.

1,017,671. Tapering Metal Bodies. C. F. Jenkins, Washington, D. C. A strop of porous material is saturated with electrolyte and has imbedded conductors connected to a battery whose positive terminal is connected to the razor.

1,017,680. Sanitary Mouthpiece for Telephones. M. M. Marcuse, assignor to West Disinfecting Co., New York, N. Y. Has an auxiliary diaphragm at the front of the mouthpiece and a laterally movable shutter with a pad containing a disinfectant

1,017,689. Electrowhistle Alarm. C. H. Rettmann, Chicago, Ill. An electromagnet in one of two compartments vibrates a diaphragm between them and thus causes air currents to surge to and fro and set up a whistling sound.



1,017,671.—Electric Strop.

1,017,694. Chandelier. A. Sechrist, Denver, Colo. Has a connector within the fixture body through which the wires from the fixture arms connect to the main in the fixture stem.

1,017,701. Electrostatic Separator. H. M. Sutton, W. L. Steele and E. G. Steele, Dallas, Tex. The comminuted material is passed across the line of travel of the electrodes.

1,017,711. Device for Holding Trolley Poles on Wires. W. F. Van Cleave and A. T. Woodall, Dallas, Tex. Has a frame to prevent disengagement of the trolley wheel.

1,017,737. Series Transformer. G. A. Burnham, assigner to Sears B. Condit, Jr., Brookline, Mass. Has primary and secondary windings and a closed-circuited tertiary winding, whereby the ratio of transformation under change of secondary load is practically uniform.

1,017,740. Electric Stock-Quotation Board. M. D. Compton, New York, N. Y. Individually controlled electric lamps illuminate translucent plates showing fractional quotations.

1,017,741. Suspension Device for Trolley Wires and the Like. F. S. Denneen, Mansfield, O. The messenger-engaging clip has two oppositely turned hooks.

1,017,759. Electric Conduit. O. T. Hungerford, Belleville, N. J. Consists of a casing with a channel for the wires which rest on porous blocks and are imbedded in bituminous compound.

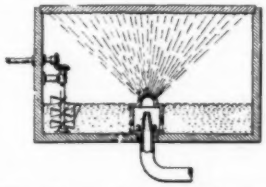
1,017,776. Method of Producing Electrotypes. H. S. Levy, Philadelphia, Pa. The electrolyte is sprayed upward against the wax matrix.

1,017,794. Circuit-Breaker for Magneto-Electric Machines. C. A. Pfanstiehl, Highland Park, Ill. Is actuated by a cam disk on the armature shaft.

1,017,825. Clutch-Controlling Device. P. Utne, assignor to Union Switch & Signal Co., Swissvale, Pa. An electromagnet controls a plunger rod that holds the clutch engaged.

1,017,834. Sound-Producing Apparatus. R. A. Whitehead, assignor of one-half to G. R. Waterman, Los Angeles, Cal. Has an electromagnetic brake for stopping the phonograph record.

1,017,874. Electric Heater. I. E. A. Kelso, Provo, Utah. Has a pair of electrodes immersed in the water beneath a steam-dome.



1,017,776—Formation of Electrotypes.

1,017,875. Electric Trap. J. Klemovics, Homestead, Pa., assignor of part to J. Pentek, B. Kun, and B. Kojsza. A casing incloses two platforms over a pit; when a rat steps on one it closes the circuit of a motor that sweeps it onto charged bars to be electrocuted and then thrown into the pit.

1,017,916. Power Hammer. G. H. Rowe, assignor to Electromagnetic Tool Co., Chicago, Ill. A cylinder contains two pistons, one acting as a core for solenoid surrounding the cylinder and the other as a pneumatic cushion.

1,017,939. Unloading Device for Motors. R. B. Williamson, assignor to Allis-Chalmers Co., Milwaukee, Wis. Closing of the motor switch permits the motor-driven pumps to start without load.

1,017,945. Commutator Construction for Dynamo-Electric Machines. T. S. Allen, assignor to Allis-Chalmers Co. Provides ventilation in the space between the commutator segments and the shaft.

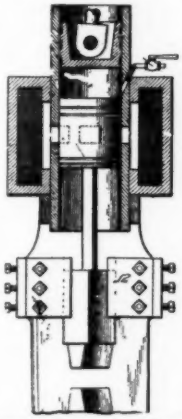
1,017,948. Switch for Ignition Systems. G. H. Boynton, assignor to Pittsfield Spark Coil Co., Dalton, Mass. Permits changing from battery to magneto ignition.

1,017,967. Telephone Selecting Device. F. E. Granger, Aberdeen, S. D. Turning of a numbered disk sends impulses to an electromagnet that steps up a ratchet wheel for a selector switch.

1,017,981. Electroplating with Zinc. A. A. Lemetre, Paris, France. The The bath consists of zinc sulphate, water, and materials capable of yielding in the bath ammonium chloride, sodium sulphate and sulphuric acid.

1,017,985. Hickey. W. R. McLain, assignor to Macallen Co., Boston, Mass. Combined with a fixture is a tubular member split at one end for the passage of wires, a ring surrounding the split end.

1,017,991. Sight-Illuminating Attachment for Guns. A. N. Olson, Idaho Springs, Colo., assignor of one-tenth



1,017,916.—Electric Hammer.

to C. C. King, Denver, Colo. Consists of a battery, miniature lamp and a switch mounted on the gun.

1,018,003. Carbon Electrode for Electrical Purposes. B. Redlich, assignor to Planiawerke Aktiengesellschaft fur Kohlenfabrikation, Ratibor, Germany. Means for joining an old to a new electrode consist of carbon connecting piece having a metal core with enlarged ends.

1,018,017. Convertible Lamp. F. D. Spear, assignor to Armspear Manufacturing Co., New York, N. Y. Can be changed from an oil lamp to an electric lamp.

1,018,019. Controller. E. W. Stull, assignor to Allis-Chalmers Co. A drum-type controller has an iron shaft and an iron plug adjacent its contact segment.

1,018,026. Safety Signal Apparatus. J. H. Alander and R. McGregor, Chicago, Ill. The controller of an electric car closes a signal circuit as long as current is supplied to the motor.

1,018,038. Signaling Apparatus for Turpentine Stills. R. Dunwody, Kirkwood, Ga. A thermostatic register

and alarm has three contacts along the thermometer tube.

1,018,082. Telephone Transmitter. C. R. Rogers, Waverly, N. Y. The mouthpiece contains an antiseptic device.

1,018,109. Rodent Exterminator. D. B. Harris, Minturn, Cal. A nozzle for spraying fluid has electrodes at its end and means for producing an electric spark between them.

1,018,115. Telegraphic System and Apparatus. C. Kinsley, Chicago, Ill., assignor to Globe Printing Telegraph Co. A set of recording pens at the receiving station is controlled by individual electromagnets.

1,018,137. Double or Twin Interrupter for Ignition Systems. J. M. Smith, assignor of one-half to W. D. C. Wright, Philadelphia, Pa. Controls a magneto or battery ignition circuit.

1,018,141. Commutator. W. G. Viall, assignor to Ives Manufacturing Corporation, Bridgeport, Conn. Has a fiber end disk with hole through which are secured the sheet-metal commutator segments.

1,018,154. Apparatus for Controlling Lights on Automobiles. J. L. Beck, Springfield, Mass. Has an electrically controlled valve in the supply from the acetylene tank and electric igniters at the burners.

1,018,162. Electric Bell. S. Brown, Alexandria, Va. Gives details of a new construction.

1,018,182. Telephone Transmitter. F. Gottschalk, New York, N. Y. Has a small auxiliary diaphragm coacting with the electrode that engages the granular carbon.

1,018,187. Lamp. William S. Hamm, assignor to Adams & Westlake Co., Chicago, Ill. An oil lamp or an electric lamp can be interchanged at the focal point of the lens.

1,018,196. Automatic Switch. C. L. Kennedy, assignor to Holtzer-Cabot Electric Co., Brookline, Mass. The movable contact is actuated by centrifugal force.

1,018,198. Trolley. H. F. Kunieski and M. Swiecicki, Philadelphia, Pa. Has a pair of guards extending over the trolley wheel.

1,018,226. Telephone Repeating System and Apparatus. C. Adams-Randall, assignor to Randall Telephone Manufacturing Co., Augusta, Me. The repeater is connected between two distinct and separate telephone circuits.

1,018,241. Shade-Holder. E. E. Forstrom, assignor to Bryant Electric Co., Bridgeport, Conn. Has an expansible beaded ring over which is fitted the shade-holder body.

1,018,246. Electrically Operated Door. G. Korytowski, Berlin, Germany. Stepping on a tread on either side of the door closes the circuit of a motor that opens the door toward the side away from the entering person.

1,018,251. Irrigation System. C. W. McKee, Phoenix, Ariz. The gates leading from the irrigating channel are electrically closed when a certain saturation of the ground is attained.

1,018,253. Mechanism Actuated by a Hot Bearing. J. McWilliams, East McKeesport, and M. E. Clelland, West Homestead, Pa. A thermostat closes an electric alarm circuit and shuts down the machine.

1,018,270. Shade-Holder Attachment for Electric-Light Sockets. P. H. Robinson, assignor to Scovill Manufacturing Co., Waterbury, Conn. Consists of a shade-holding ring with rabbeted flange fitting on a spring collar.

1,018,297. Switch and Cutout Box. W. P. Carstarphen, Jr., Denver, Col. A flush wall box has the hinge for its lid arranged so that the lid swings free of the wall.

1,018,304. Fog-Signal Light. R. C. Douglas, Oakland, Cal. An electric motor drives a revolving electrode so it makes sliding contact with the stationary electrode.

1,018,309. Electromagnetic Engine. H. J. Ford, San Quentin, Cal., assignor of one-half to W. J. Hill. A set of solenoids has reciprocating cores that turn a shaft through connecting rods and cranks.

1,018,322. Voltage-Regulating System. R. P. Jackson, assignor to Westinghouse Electric & Manufacturing Co. A modification of No. 1,017,670, in which the alternator field is adjusted to compensate for wattless current.

1,018,328. Mine-Alarm Instrument. H. W. Lee and G. H. Weedman, Mount Morgan, Queensland, Australia. Along a telescoping rod adjustable

1,017,985.—Hickey.

contacts are arranged to close an alarm circuit when a settlement of the roof occurs.

1,018,334. Spring Contact Plates. T. E. Murray, New York, N. Y. Two looped spring contact plates are arranged side by side so that a plug terminal can enter between them.

1,018,355. Battery for Cleaning Tarnished Metals. R. H. Galbraith, Denver, Colo. A layer of metal mesh is applied on opposite sides of the battery plates.

1,018,356. Audiphone Rheostat and Switch. K. B. Hastings, assignor to Globe Ear-Phone Co., Boston, Mass. A button slides in a slot in a case and makes contact with various resistance contacts.

1,018,358. Combined Policeman's Club and Light. R. L. Litsey, Seattle, Wash. In the handle is a battery and miniature lamp set.

1,018,375 and 1,018,376. Signaling System. H. O. Rugh, assignor to Sandwich Electric Co., Sandwich, Ill. A selective ringing system for telephone party lines has a step-by-step selector at each substation.

1,018,381. Electrical Circuit Switch. J. M. Smith, assignor of one-half to W. D. Wright, Philadelphia, Pa. A switch for changing from battery to magneto ignition, or the reverse.

1,018,383. Sparking Plug. G. S. Walker, Boston, Mass., assignor of one-half to E. J. Chadbourne, Wakefield, Mass. Gives details of an ignition plug.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired Feb. 26, 1912.

534,642. Railway Supply System. H. F. Gray, Passaic, N. J.

534,650. Electrically Actuated Combination Lock. S. L. G. Knox, Camden, N. J.

534,662. Electric Railway System. H. A. F. Petersen, Milwaukee, Wis.

534,663. Underground Conduit for Electric Railways. H. A. F. Petersen, Milwaukee, Wis.

534,670. Telegraph and Telephone System. C. A. Rolfe, Chicago, Ill.

534,671. Fire-Alarm-Telegraph System. C. A. Rolfe, ,Chicago, Ill.

534,676. Clutch for Shafts. E. A. Sperry, Chicago, Ill.

534,677. Electric Arc Lamp. H. O. Swoboda, New York, N. Y.

534,678. Electric Current Transformer. J. A. G. Trudeau, Ottawa, Can.

634,699. Electric Resistance Card. A. J. Shaw, Muskegon, Mich.

534,729. Commutator. D. P. Thomson, Schenectady, N. Y.

534,730. Means for Operating Drills. E. Thomson, Swampscott, Mass.

534,731. Method and Means for Preventing Magnetic Leakage. E. Thomson, Swampscott, Mass.

534,732. Connector for Electric Conductors. R. D. Titcomb, Schenectady, N. Y.

534,779. Signaling System. C. H. Brace, Union City, Mich.

534,785. Method of and Apparatus for Insulating Electrical Conductors. L. W. Downes, Providence, R. I.

534,786. Apparatus for Manufacture of Insulated Electrical Conductors. L. W. Downes, Providence, R. I.

534,802 Electric Metal-Working Apparatus. H. Lemp, Lynn, Mass.

534,815. Electric Slot for Signals. J. P. Coléman, Swissvale, Pa.

534,819. Paper-Registering Machine. T. C. Dexter, Fulton. N. Y.

534,826. Signal. E. H. Goodman, Pittsburgh, Pa.

534,834. Battery System for Electric Railways. E. Julien, Brussels, Belgium.

534,852. Electric Arc Lamp. J. Brockie, Forest Hill, England.

534,886. Electrical Lighting Device for Gas Engines. C. L. Ives, Grand Rapids, Mich.

534,888. Lamp. H. E. Keeler, New York, N. Y.

534,908. Electric Signaling Apparatus. B. J. Noyes, Boston, Mass.

534,942. Manufacture of Articles by Electrodeposit. H. S. Anderson, Springfield, Mass.

534,953. Dynamo-Electric Machine. R. Eickemeyer, Yonkers, N. Y.

534,956. Electric Trolley Railway. J. M. Hammill, Aldan, Pa.

534,961. Electrically Operated Keg Register. J. Kuff, New York, N. Y.

534,970. Telegraph and Telephone System. C. A. Rolfe, Chicago, Ill.

534,971. Incandescent Light. H. P. Rooney, Randolph, Mass.

534,974. Electric Brake. E. A. Sperry, Cleveland, Ohio.

534,975. Apparatus for Arresting Motion of Electrically Propelled Mechanism. E. A. Sperry, Cleveland. Ohio.

534,977. Electric Brake. E. A. Sperry, Cleveland. Ohio.

534,986. Conduit Electric Railway. M. F. Flynn, Stamford, Conn.